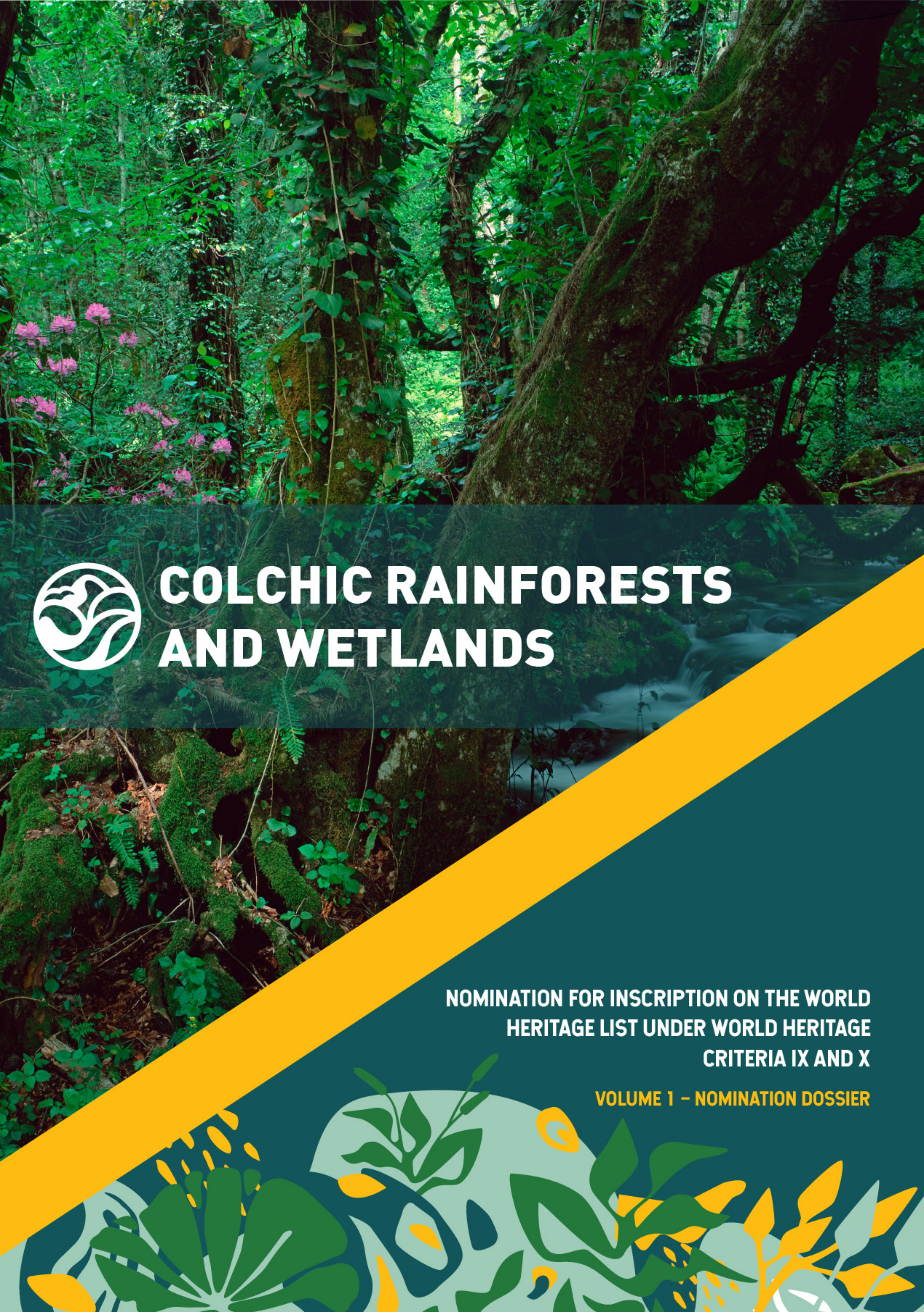

COLCHIC RAINFORESTS AND WETLANDS

NOMINATION FOR INSCRIPTION ON THE WORLD
HERITAGE LIST UNDER WORLD HERITAGE
CRITERIA IX AND X

VOLUME 1 – NOMINATION DOSSIER

2. DESCRIPTION

2.A DESCRIPTION OF PROPERTY

This Chapter starts with a general description of the Colchic Rainforests and Wetlands (Section 2.a.1), which is followed by an overview of how the features with relevance to its proposed Outstanding Universal Value are distributed in a complementary way between the nominated component areas of the series (Section 2.a.2). A detailed separate description of each of the seven nominated component areas of the series concludes this Chapter (Section 2.a.3 – 2.a.9).

2.a.1 General description of the Colchic Rainforests and Wetlands

Location and topography

The Colchic Rainforests and Wetlands occupy the central part of the Colchic region, which in turn is part of the Caucasus region. The Colchic region wraps around the eastern coast of the Black Sea, extending from the Melet River near Ordu in Turkey to the northern border of Abkhazia Autonomic Republic in Georgia (Figure 7). Some authors put its northern border even further to the north, near the Taman Peninsula in Russia's Krasnodar Krai (e.g. Nakhutsrishvili et al. 2015), corresponding to a latitude range of between ca. 40°30' and 44°60' N. This means that the Colchic region extends into Turkey to the south and – depending on the author – into Russia to the north, but has its central and most typical part within Georgia.

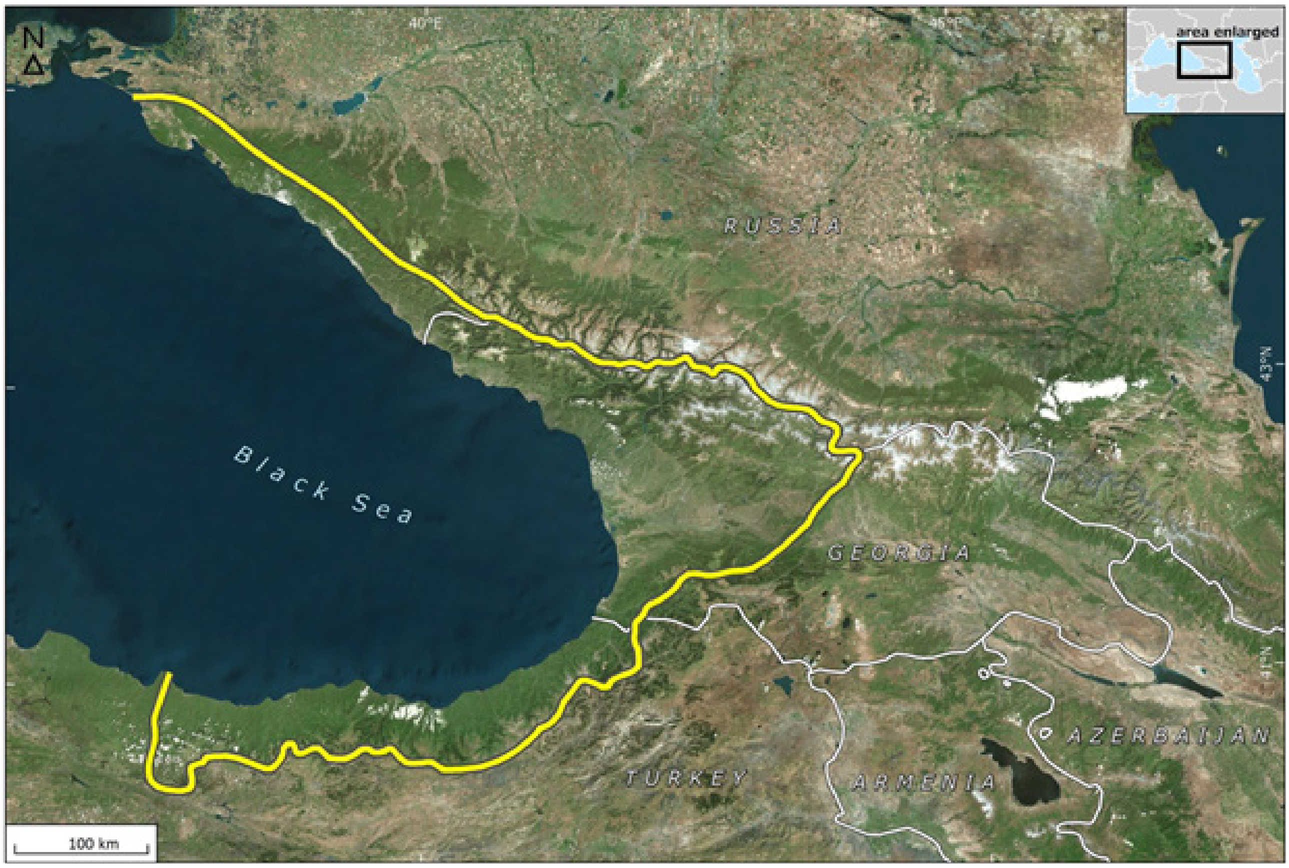

Figure 7. Overview over the wider Colchic area (source: Nakhutsrishvili et al. 2015).

This central part of the Colchic region, where the Colchic Rainforests and Wetlands are located, includes the Colchic Lowlands, as well as the converging slopes of the Greater Caucasus to the north and the Lesser Caucasus to the south. Both are connected by the Likhi (or Surami) range. This range links Greater and Lesser Caucasus to the east of the Colchic Lowlands, closing the so-called "Colchic Triangle" (Figure 7). In terms of altitude, the central Colchis area ranges from sea level to about 2,800 m a.s.l.

As a consequence of this context, the nominated component areas of the Colchic Rainforests and Wetlands (Figure 2-6) are distributed between two different but immediately adjacent and interconnected topographical settings: The largest and southernmost nominated component area (Mtirala-Kintrishi) is situated in the Adjara-Imeretian (Meskheti) mountain range within the western Lesser Caucasus, at altitudes ranging from 250 m to > 2,700 m a. s. l (Figure 2). This steep mountainous area has a complex relief (see Section 2.a.3 for details).

All other nominated component areas of the Colchic Rainforests and Wetlands are situated within the Colchic Lowlands, at altitudes below 10 m a.s.l. (Figures 3-6). All are within 20 km from the seashore, and four out of six are less than 2 km distant from the seashore at the nearest point. However, these are not coastal wetlands in the strict sense and do not correspond to any of the coastal wetland types as identified by the Ramsar Convention (Ramsar Convention Secretariat 2008). They lack a direct connection to the Black Sea and the water bodies located there are only slightly brackish (maximum salinity at lake Paliastomi 12 Practical Salinity Units). This is because the Black Sea has a salinity of less than 17 PSU and is non-tidal, and because there is a constant inflow of freshwater from streams and precipitation (cf. discussion of climate below). This prevents brackish water inflow even where indirect connections through rivers or coastal freshwater lagoons to the sea exist.

Biogeographic context

The Colchic Rainforests and Wetlands are part of the ***Caucasus Ecoregion***, a global biodiversity hotspot (Mittermeier et al. 2004, Williams et al. 2006). The "System of Biogeographical Provinces of the World" established by Udvardy (1975) does not capture this ecoregion well: Geographically, the Colchic region overlaps with the provinces ***"Mediterranean Sclerophyll" and "Caucaso-Iranian Highlands" of the Palaearctic Realm***, but these categories do not reflect its peculiarities.

In the more recent classification of terrestrial ecosystems of Olson et al. (2001), the Colchic forests are part of the neighbouring ecoregions of ***Euxine-Colchic Broadleaf Forests and Caucasus Mixed Forests within the Temperate Broadleaf and Mixed Forests Biome of the Palaearctic Realm***. Olson & Dinerstein (2002) include them in the Global 200 Priority Ecoregion ***Caucasus-Anatolian-Hyrcanian Temperate Forests***.

From a freshwater perspective, the Colchic wetlands fall into the freshwater ecoregion of Western Transcaucasia as identified by Abell et al. (2008), and do not coincide with any freshwater priority ecoregion as listed by Olson & Dinerstein (2002).

While the above biogeographic classification schemes set the general biogeographic context of the Colchic Rainforests and Wetlands, they lack both the thematic focus and the geographic width to provide a reference framework to explain the Outstanding Universal Value (OUV) of the nominated property, or to identify all possible sites for Global Comparative Analysis. Therefore, they need to be complemented with biogeographic classification schemes that are more relevant to the property's proposed OUV. Since the proposed OUV of the property is associated mainly with forests and wetlands (particularly peatlands), these global classification schemes also focus on forests and peatlands.

Forests:

- From a global plant-geographical perspective (Schroeder 1997) the Colchis is part of the ***South-Euro-Siberian plant-geographical Region***, which corresponds with the East-North-American and the Sino-Japanese Regions in the ***nemoral zone*** of the ***Holarctic Realm***. The humid parts of these three large regions are divided in several types, according to the climatic subdivisions of the temperate humid deciduous forest climate.
- In the plant-geographical division by Meusel et al. (1968-1992) the Colchis is defined as the ***Colchic Sub-province of the Euxinic Province within the Sub-Mediterranean Sub-region of the wider Macaronesian-Mediterranean plant-geographical Region***. From the vegetation-geographical point of view the Colchis is defined on this basis as ***Colchic District within the Euxinic-Hyrcanian oak mixed and beech forest Province of the Sub-Mediterranean deciduous forest region*** (Knapp 2005a).

- Within the above context, the map of natural vegetation of Europe (Dolukhanov & Nakhutsrishvili in Bohn et al. 2000/2003) characterizes the Colchis vegetation complex based on a number of specific components according to the altitudinal belts (Box 1).
- The Colchic Forests can also be classified as warm-temperate rainforests (Nakhutsrishvili et al. 2011), and have been compared with other temperate rainforests (e.g. DellaSala 2011).

Box 1. Characterization of the Colchic forests based on components of its vegetation in the Map of the Natural Vegetation of Europe, according to the altitudinal belts (Dolukhanov & Nakhutsrishvili in Bohn et al. 2000/2003).

- S 26 – Colchic herb-rich tall sedge fens with *Carex acuta, Cladium mariscus, Ludwigia palustris* in combination with *Sphagnum* mires (*Sphagnum austinii, S. papillosum*) with *Rhododendron luteum, Osmunda regalis, Rhynchospora caucasica*.
- T 3 – Colchic alder cars (*Alnus barbata*) in combination with alluvial forests (*Alnus barbata, Fraxinus excelsior, Pterocarya pterocarpa*), tall reed vegetation (*Phragmites australis, Typha latifolia*) and sedge swamps (*Carex* spec.).
- H 1 – Colchic lowland to submontane mixed oak forests (*Quercus imeretina, Qu. Hartwissiana, Zelkova carpinifolia, Carpinus betulus, Castanea sativa, Fagus orientalis*) with evergreen understory species (*Rhododdendron ponticum, Prunus laurocerasus*), alternating with oak and hornbeam-oak forests (*Quercus iberica, Carpinus betulus*) in the submontane belt.
- F 169 - Colin-submontane East-Euxinian oak and hornbeam-oak forests (*Quercus iberica, Carpinus orientalis, C. betulus*), alternating with hornbeam-chestnut-beech forests (*Fagus orientalis, Castanea sativa, Carpinus betulus*) with evergreen understorey.
- F 163 – East-Euxinian beech forests (*Fagus orientalis*) partly with Picea orientalis, mostly with evergreen understory (*Prunus laurocarasus, Rhododendron ponticum, Daphne ponticum*) with *Hedera colchica, Ilex colchica, Ruscus colchicus*.

In conclusion, the most humid parts of the South-Euro-Siberian, East-North-American and Sino-Japanese plant-geographical Regions represent the general and main biogeographic context for the further evaluation of the Colchic forests (Chapter 3).

Wetlands, particularly peatlands:

The Colchic Wetlands comprise a wide range of ecosystems (see Section on ecosystems, habitats and vegetation below for details) but by far the most relevant to the proposed OUV of the series are peatlands. Box 6 explains key terms in relation to them.

Peatlands are mainly distributed in the temperate and cold belt of the northern hemisphere with a proportion being around 90% (Lappalainen 1996). The main peatland areas are in northern Europe, western Siberia, North America and also in the humid tropics (Figure 8) (Pfadenhauer et al. 1993).

The Colchic mires can be put into biogeographical and functional context using (1) the pan-European typology of mire regions of Moen et al. (2017), and (2) the hydrogenetic mire classification of Succow & Joosten (2001) and Joosten and Clarke (2002).

- The typology of European mire regions takes into account biological, hydrological and geographic criteria. Within this typology, the peatlands of the Colchis form one of ten distinct mire regions of pan-Europe, the Colchis mire region (Moen et al. 2017). Reflecting the warm-temperate environment, this region forms a structural and functional transition between the peatlands of the boreal and those of the tropical zones (Joosten et al. 2003).

- The globally applicable hydrogenetic mire classification was derived from a synthesis of various mire classification systems and focuses on the processes that drive peat formation and peatland development (Joosten et al. 2017). Special attention is paid to interrelations and feedback mechanisms between (a) water flow and fluctuations, (b) vegetation and (c) peat formation, as well as to the role peatland development plays in landscape hydrology. According to this fundamental classification, the characteristic hydrogenetic mire type of the Colchis mire region is the ombrogenous percolation mire (Joosten & Clarke 2002), or percolation bog (Kaffke 2008, de Klerk et al. 2009, Krebs et al. 2017), where water flows through the entire peat body (Figure 9). Percolation bogs have a convex shape indicating ombrogeneity (purely rain fed conditions), are typically weakly decomposed over a large depth (without a clear horizontal zonation in acrotelm and catotelm) and with predominantly vertical water flow, which consequently do not develop explicit surface patterning (Joosten & Clarke 2002, Couwenberg & Joosten 1999, de Klerk et al. 2009). This mire type only occurs in the Colchis mire region and nowhere else in the World. This is due to the combination of a high annual temperature (~14.5 °C) and a high amount of precipitation (~2,000 mm), evenly distributed over the year (Krebs et al. 2017).

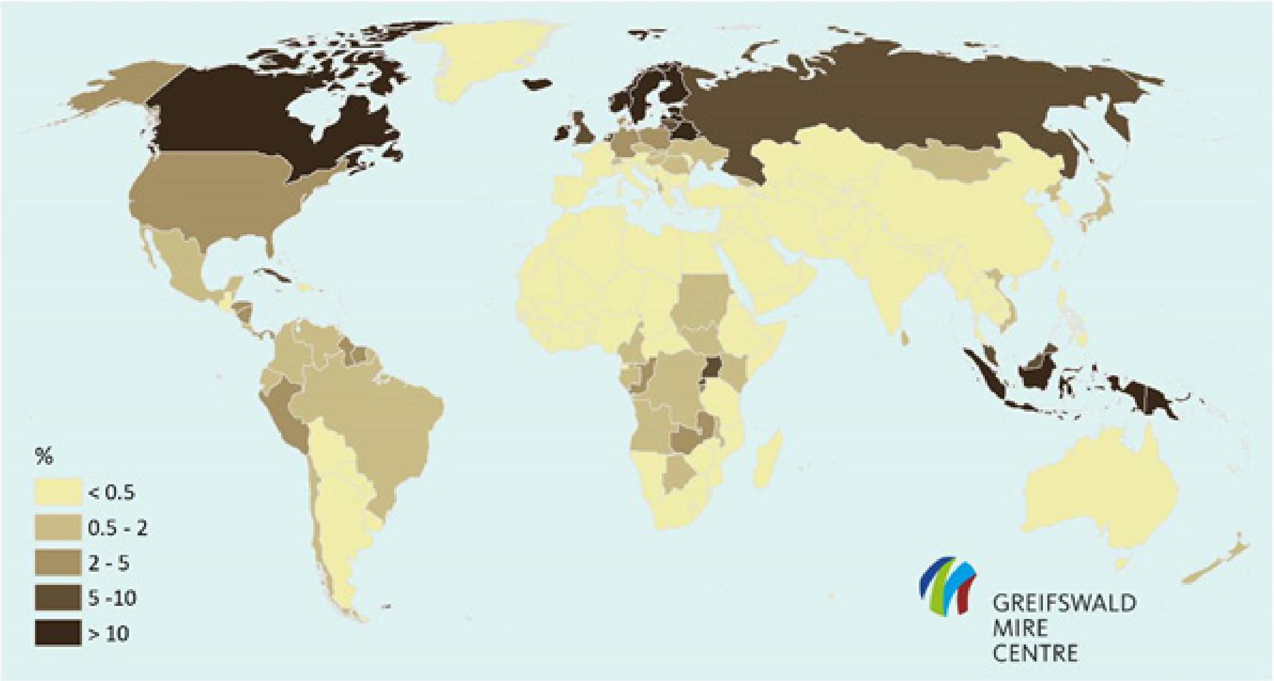

Figure 8. Global distribution of peatlands (area percentage by country). Source: Greifswald Mire Centre

In conclusion, the interrelated systems of pan-European mire regions by Moen et al. (2017) and of globally applicable hydrogenetic mire types by Joosten et al. (2017) set the biogeographic context within which the Colchic peatlands as the dominating and most relevant wetland ecosystem of the Colchic wetlands – from the point of view of its proposed OUV – will be evaluated further (Chapter 3.2.2).

Geology

The Adjara-Imeretian (Meskheti) mountain range, where the southernmost nominated component area of the Colchic Rainforests and Wetlands is situated, belongs to the Lesser Caucasus, a mountainous area formed mainly by a segment of the Alpine-Himalayan mountain belt. It is composed of Eocene volcanogenic and sedimentary rocks. Among them are basalts, andesites, massive and thick-layered breccias, tuffs, tuffo-sandstones, and marls. The layering is complicated by faults and overthrusts (Gobejishvili & Tielidze 2018).

To the north of the Adjara-Imeretian mountain range lies the Kolkheti Lowland. This has been created by river sediments in a sea gulf. Its present relief reflects both submersion and accumulation of river deposits (Krebs et al. 2017). The Kolkheti Lowland is a subsiding basin that may have originated during the Late Eocene or the Oligocene-Miocene Boundary (Saintot et al. 2006).

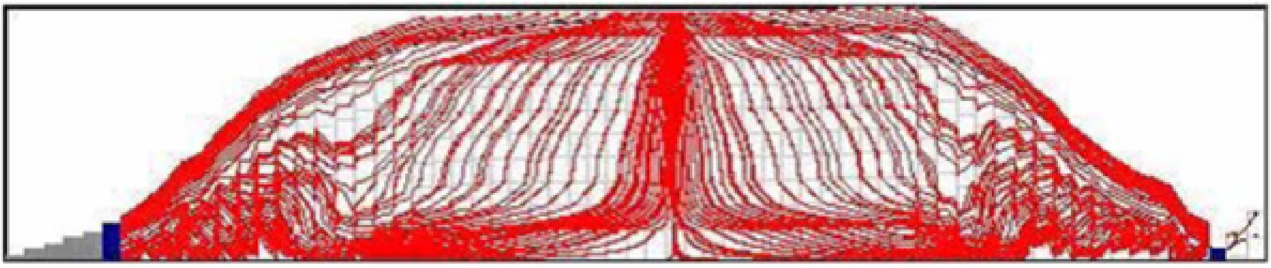

Figure 9. Schematic representation of water flow through a rain percolation bog, as the typical type of bog in the Colchic Rainforests and Wetlands. In contrast to other types of mires, water flows through the entire peat body, making this an “ideal” type of bog. (Source: Matthias Krebs

Climate

The Colchic zone has a warm-temperate climate (Figure 10). Summers are moderately warm (24-25 °C) and winters cool (4-6 °C) (Nakhutsrishvili et al. 2011). The location and topography of the Colchic triangle result in ***very high average*** annual precipitation of 1,800-2,200 mm, and ***exceptionally high local*** precipitation averages, such as on Mount Mtirala within Mtirala-Kintrishi nominated component area (4,500 mm). Precipitation is distributed relatively evenly throughout the year (Nakhutsrishvili et al. 2011), with maxima in December (303 mm in Batumi) and minima in May (84 mm) (Climate-Data.Org 2017).

The exceptionally high precipitation in the Colchic area is the result of the funnel formed by the Greater and Lesser Caucasus, as well as the Likhi range which connects them in the east (see discussion of Colchic triangle above). These mountain ranges trap much of the moisture arising from the Black Sea on their windward side (Nakhutsrishvili et al. 2011).

The Colchic climate should be considered warm-temperate not subtropical: Air temperatures are lower compared with subtropical areas, and the seasonality of precipitation is not as pronounced, with significant rainfall throughout the year. This is reflected in the Colchic forest vegetation, which is more appropriately described as hygro-thermophilous temperate broadleaf forest (Dolukhanov 1980), or temperate rainforest (Nakhutsrishvili et al. 2011). The warm-temperate and extremely humid climate of the Colchic Rainforests and Wetlands is an important determining factor of their vegetation and biodiversity, which in turn support their proposed OUV. The structure and function of both forest and peatland ecosystems within the series can be understood as its result.

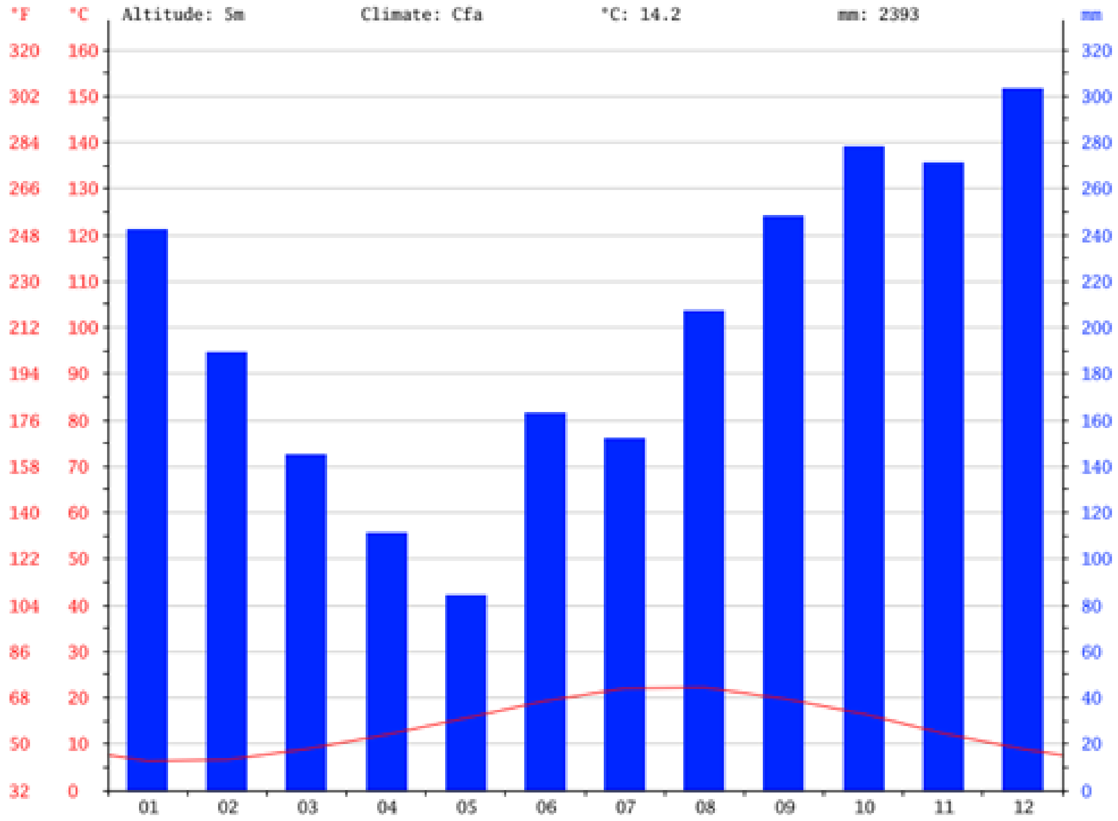

Figure 10. Climate diagramme for the city of Batumi, Georgia. See also specific climate diagrams for nominated component areas. Source: Climate-Data.Org.

Precipitation decreases from the southern (up to 4,500 mm annual precipitation) to the northern nominated component areas of the series (less than 1,900 mm) (Joosten et al. 2003). An overview putting climate and precipitation patterns in the Colchic Rainforests and Wetlands into eco-regional context is presented in Figure 11.

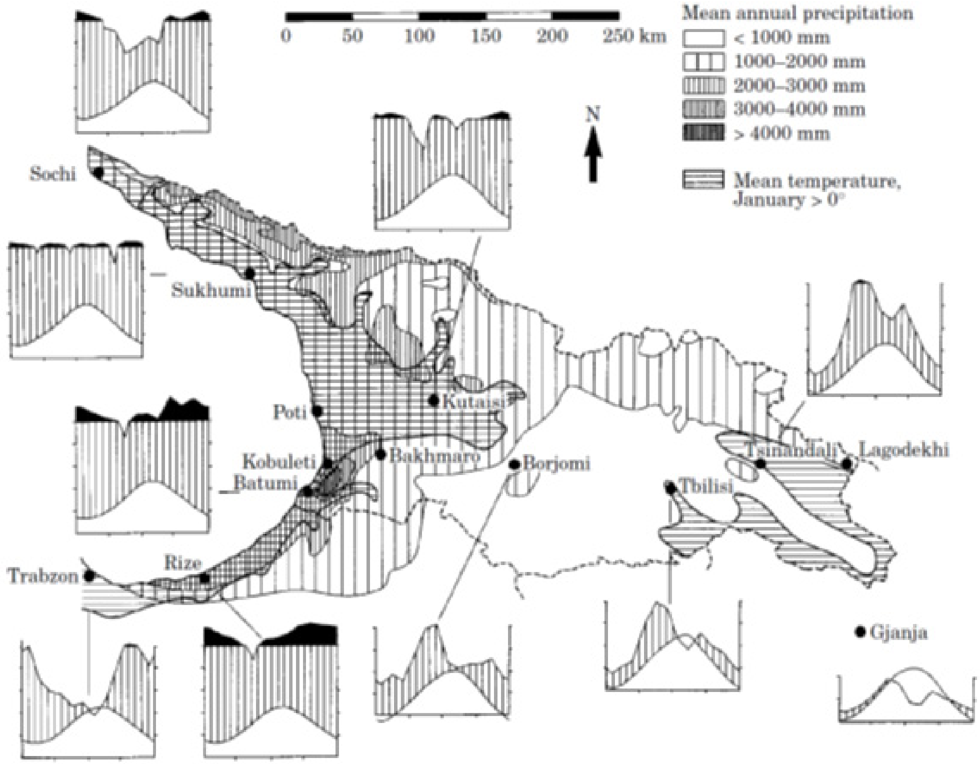

Figure 11. Map of Georgia showing mean annual precipitation and temperature in the areas under study. Climatic diagrams after Walter & Lieth (1960–67). Source: Denk et al. (2001).

The Colchic forests and their biota have survived the glacial cycles of the Pleistocene, which partly explains their current biodiversity, particularly regarding endemic and relict species. However, the region is currently experiencing a trend towards increased temperature and humidity (EnvSec 2011), and is likely to continue doing so in the future (Sylven et al. 2008). Based on temperature and precipitation data dating back to 1936 and assuming that observed trends will continue, it has been projected that precipitation on the Black Sea coastline and Colchis lowland will increase by 50% and amounts to 3,000 and 6,000 mm by the end of the century; a longer rainy period might increase the risk of flooding. An increase in the number of hot days in the area has also been projected (Elizbarashvili et al. 2017).

Hydrology

The hydrology and hydrological regime of the Colchic Rainforests and Wetlands has a vital importance for its ecosystems and habitats. The area is characterized by numerous big, medium and small-size rivers as well as lakes and wetlands. The river Rioni is the main artery of the hydrographical network of the Colchic Lowlands, although most of the nominated component areas depend on other, smaller rivers (see Section 2.a.3 below). The length of the river is 327 km and it heads on the southern slope of the Caucasus Ridge, at 2,620 m a.s.l. It crosses the whole of Kolkheti Valley and flows into the Black Sea at the city of Poti. The area of its catch basin is 13,400 km^2. The catchment of the river covers almost half of West Georgia, with Kolkheti Valley occupying 19% of it. The River Rioni is fed with glaciers, snow, rain and ground waters. Its water regime is characterized by spring floods and freshets. A relatively stable low-flow period is fixed in autumn and winter months. The river is flown by its most important tributaries as it flows across Kolkheti valley, such as Jojora (with the length of 50 km), Kvirila (140 km), Khanistskali (57 km), Tskhenistskali (176 km), Noghela (59 km), Tekhuri (101 km), Tsivi (33 km).

The main hydro-arteries on the slope of Kobuleti-Chakvi ridge (Mtirala-Kintrishi nominated component area) are the rivers Chakvistskali and Korolistskali directly running into the Black Sea, and tributaries of the rivers Ajaristskali, Dologani, Zundagistskali and some others on the south slope of the ridge, outside the nominated component area. Several of them run through beautiful gorges creating rapids and waterfalls.

The rivers - Natanebi, Ochkhamuri, Cholokhi, Shavi Ghele, Togoni, Adjkhva and Kintrishi are flowing into the Kobuleti wetlands (around Ispani nominated component area) and adjacent north and south parts of the sea-side. No river of Kobuleti municipality originates from permanent snow and glaciers. They are mostly fed by precipitation, seasonal snow-melting and groundwater. Therefore, they are often characterized by high level of volume, fast flow and cause often floods during spring and autumn seasons.

The Supsa, Rioni, Khobistskali, Tekhuri and Enguri are the biggest transit rivers that are flowing through the territories of Kolkheti National Park. Maltakva, Dedbera, Cia, Tsivi and Churia are non-transit rivers that are generated by the Colchic wetlands. The macrometer index of some small rivers in the Kolkheti Area is as follows: The river Churia, which is 11 km long and has the basin area 295-km^2, flows into the Black Sea. The river Pitshora, the length of which is 61 km and the basin is 406 km^2 and the river Thkorina with 16 km length and 56-km^2 basin area is connected to the Paliastomi Lake. The river Munchia with 39 km length and 80 km^2 basin is connected to the river Churia. The 11 km long river Tsia with 28.9-km^2 basin joins the river Tsivi and the latter with 33 km length and 254 km^2 basin flows into the river Khobistskali. The rivers of the Kolkheti area are generally characterized by seasonal runoff. Floods in all seasons of the year are common. Periodically, catastrophic floods, especially on the river Rioni were observed in 1842, 1895, 1922, 1983 and 1987.

A significant role within the hydrologic regime of the Kolkheti territories plays also Paliastomi Lake which is the largest of over 40 other smaller lakes in the Kolkheti wetland complex. It area is 23.2 km^2 with a catchment area of 547 km^2. The maximum depth of the lake is 2.6 m and the average depth is 1.3 m. In the lake, there are inflows from the three rivers: Shavi Ghele - in the northwest, Pitshora in the north-east and Tkhorina (its tributary Gurinca) in the south. From the lake, the river Kaparcha is flowing out. The river Shavi Ghele is 4 km long. During the floods of the Rioni River, turbid water masses reach the lake through the Shavi Ghele River.

Oppositely, the Shavi Ghele river basin is fed by the Paliastomi Lake when the water level in the river is low.

A crucial role for the Paliastomi lake and the neighbouring nominated component areas of Imnati and Pitshora has the River Pitshora. Similarly to the Shavi Ghele River Rioni river water flows to the lake through Pitshora. The river Tkhorina originates from the Imnati mire territories. Lithological, paleontological and other analyses of the Paliastomi Lake showed that the lake was created from Lake sediment (clay, sapropel) and peat monolithic layers. The Paliastomi Lake is the best example of different sedimentary horizons of the same age. The deepest and the oldest layer (10-11 m) is the upper layer of the Paliastomi Lake. The fact that the sea-origin sediments are developed in the Paliastomi lake areas and that they are located under the peat and lake generated clay-sapropel layers indicates that the Paliastomi lake formation started 5-6 thousand years ago from the relict lagoon of the sea and this process is still continuing.

A number of the nominated component areas are located in the vicinity of the Black Sea coast. The sea coastal area includes a shelf that covers an average 5 miles from the coastline. The surface of the shelf is not very inclined. For example, the depth of 20 m from the coastline continues until 1,300-1,400 m from the shore. Circulation of air masses on the Black Sea coastal waters leads to cyclonic rotation of water flow (counter-clockwise rotation). The speed of the flow is usually approximately 1 km per hour, while during the strong winds the speed reaches up to 5-6 km. Western winds and waves prevail over the year and the North-West winds are observed during winter. There are also strong storms during which the maximum height of the waves varies between 3-6 m. Very rarely the wave height can reach 8 m. Water salinity on the surface of the open sea is 17-18 %, varying with the 3-9 % at the large river inflows.

Soils

The soils in the area of the Colchic Rainforests and Wetlands form a marked altitudinal series but are also influenced by local variability in bedrock and vegetation. The following main soil types predominate (Urushadze & Blum 2014):

- **Marshy organic soils:** This is the predominant soil type of the Kolkheti Lowland. These soils involve silt and organic (peat) bog soils. The soils are partly composed of alluvial material, which is produced by rock weathering in the North and South Caucasus. These deposits contain mostly carbonates, which are shared with clay in the upper stratum. Mineral marshy soils are characterized by weakly acid or neutral reaction, a high content of humus and a heavy texture in all profiles, highly dispersive. Bog soils are characterized by an increased content of different forms of iron. While an accumulation of amorphous iron oxides is found in the upper part of the profile, well crystallized oxides are found deeper down.
- **Red Soils:** This soil type, which is usually found in the humid tropics and subtropics, is characterized by its red colour, clayization and usually by great soil depths. The soil profile shows the following horizons: A-AB-B-BC-C. They are distributed in the lower part of the Adjara-Imeretian mountain range up to 300 m a.s.l. and formed by red weathering products of effusive rocks (primarily andesite) and their derivatives. The depth of the ground water table is 8-10 m. Red soils are acid, and characterized by heavy clay loam, clay and heavy clay texture. The content of humus is medium or high. The mineral part of soils is characterized by ferrallitic weathering. The formation of red soils needs drainage and intensive leaching conditions, so that an intensive and long weathering is necessary for the formation of these soils.
- **Yellow soils:** These are characterized by yellow colours, clayization and usually by deep profiles. The soils show the following horizons: A-AB-B-BC-C. These acid soils are widely distributed in the lower mountainous belt of the Adjara-Imeretian mountain range at altitudes of 250 to 600 m a.s.l. The soil forming rocks are acid, and typically consist of weathered schists. On the terraces, these soils are usually developed on clay deposits. Soil forming rocks are characterized by properties that promote erosion and landslides. The content of humus ranges from 2% to 7%, and sharply decreases with depth. The texture also changes significantly with depth. The distribution and properties of yellow soils are determined by their parent rocks. During the soil forming processes a mobilisation of iron takes place, parallel to the formation of iron hydroxides. The latter determines the yellow colour of the soils.

- **Yellow-brown forest soils:** These soils are characterized by well expressed humus and a yellowish brown illuvial horizon, with the horizons: A-AB-B1-B2-C1-C2orA-B1-B2-C1-C2orA-AB-B-B1B2-BC. They are distributed in the Colchic region between the yellow, red and brown forest soils at altitudes from 400 to 1,000 m a.s.l. The parent rocks of these acid, humus-rich soils are middle jurassic porphyrite, porphyr and effusive rocks and their derivates on old denudation surfaces. Yellow brown forest soils have a heavy loamy texture. They are characterized by an insignificant or a total lack of clay movement. In comparison to brown forest soils, yellow brown soils are richer in iron oxides. Their accumulation in the illuvial horizon is explained by intensive leaching. In the formation of the yellow brown forest soil biological turnover processes are of particular significance. This biological activity limits the podzolization process.
- **Brown forest soils:** This forest type is characterized by a weakly differentiated profile, with the A0 - A - Bm - C. The main diagnostic feature is the metamorphic clay in the Bm horizon. These soils occur between 800 m and 2,000 m a.s.l. and are the most widespread soil type of the Colchic forests. Brown forest soils are mainly developed on slopes, which determine free inter-soil drainage. Their formation of these soils occurs on tertiary sandstones and clay slates, clay deposits and conglomerates. They do not freeze or freeze only for a short period, which allows an intensive weathering and formation of secondary minerals. Brown forest soils are characterized by a weak acid reaction. The content of humus sometimes reaches 1% in the lowest horizons. The texture of brown forest soils is light sandy, loamy, rarely heavy. In most cases, the content of clay and silt increases with depth. Brown forest soils develop under humid conditions in deciduous, mixed or coniferous forests with well developed grass cover, in well-drained conditions, in the absence of prolonged soil freezing.
- **Mountain meadow soils:** These soils are characterized by non-differentiated profiles, with the horizons At-A-B-BC. The main diagnostic signs are a well-expressed humus horizon over a small weathering horizon. Mountain meadow soils are widely distributed in the narrow subalpine belt that forms part of the series at Mtirala-Kintrishi, above 1,800 m a.s.l. They are formed under extreme climatic conditions, with long snow cover and cool summers. The cold climate of the high mountains supports an intensive weathering of the rocks and this leads to an accumulation of a great number of rock fragments on the soil surface. As a result denudation processes in mountain meadow soils are comparatively young. They are characterized by an average or little depth, turf material of the surface, loamy or clayey texture, mainly acid or weakly acid reaction, with high and deep humus formation.

Ecosystems, habitats and vegetation

The Colchic Rainforests and Wetlands capture an entire altitudinal series of typical Colchic ecosystems running from sea level to almost 2,800 m a.s.l. (Figure 12). Reflecting their geographic location and biogeographic context as discussed above, their predominant ecosystems are forests and peatlands. These are also by far the most important ecosystems of the Colchic Rainforests and Wetlands in terms of their proposed Outstanding Universal Value, particularly in relation to World Heritage criterion ix.

In addition, there are a number of other ecosystems that immediately surround these key elements, functionally interact with them, and provide habitats for some of their biodiversity (at least during parts of the lifecycle). These are also included within the nominated component areas where appropriate. They include permanent freshwater bodies and some subalpine meadow ecosystems.

While only Colchic forests and some subalpine meadow ecosystems are found at the mountainous Mtirala-Kintrishi nominated component area, Colchic lowland forests and peatlands are intricately mixed in several of the other nominated component areas in the Colchic Lowlands (see Chaper 2.a.2 and 2.1.3 below).

On the basis of this general overview, the general description of the ecosystems, habitats and vegetation of the Colchic Rainforests and Wetlands can be structured as follows:

Characterization of forest ecosystems, habitats and vegetation of the Colchic Rainforests and Wetlands: The Colchic rainforests include several types (see below) but their major and overall distinguishing feature is semi-prostrate evergreen shrubs characterized by vegetative reproduction forming dense understoreys up to 3-4 m tall and containing evergreens (Figure 13), such as *Rhododendron ponticum, R. ungernii, R. smirnovii* (the last two being local endemics of southern Colchis), *Laurocerasus officinalis,* and *Ilex colchicum* (Ketskhoveli 1960, Nakhutsrishvili 1999, Zazanashvili et al. 2000, Dolukhanov 2010, Nakhutsrishvili et al. 2010).

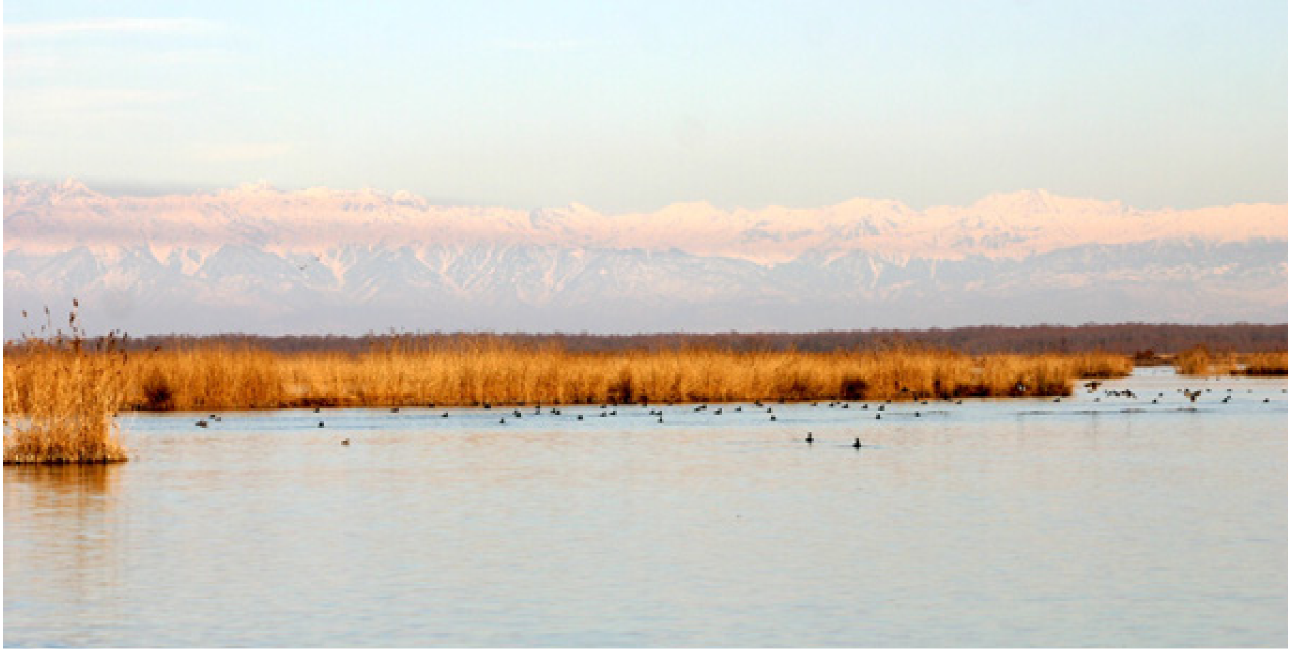

Figure 12. View over Paliastomi Lake and Imnati nominated component area towards Mtirala-Kintrishi nominated component area in winter. (Photo: Izolda Matchutadze)

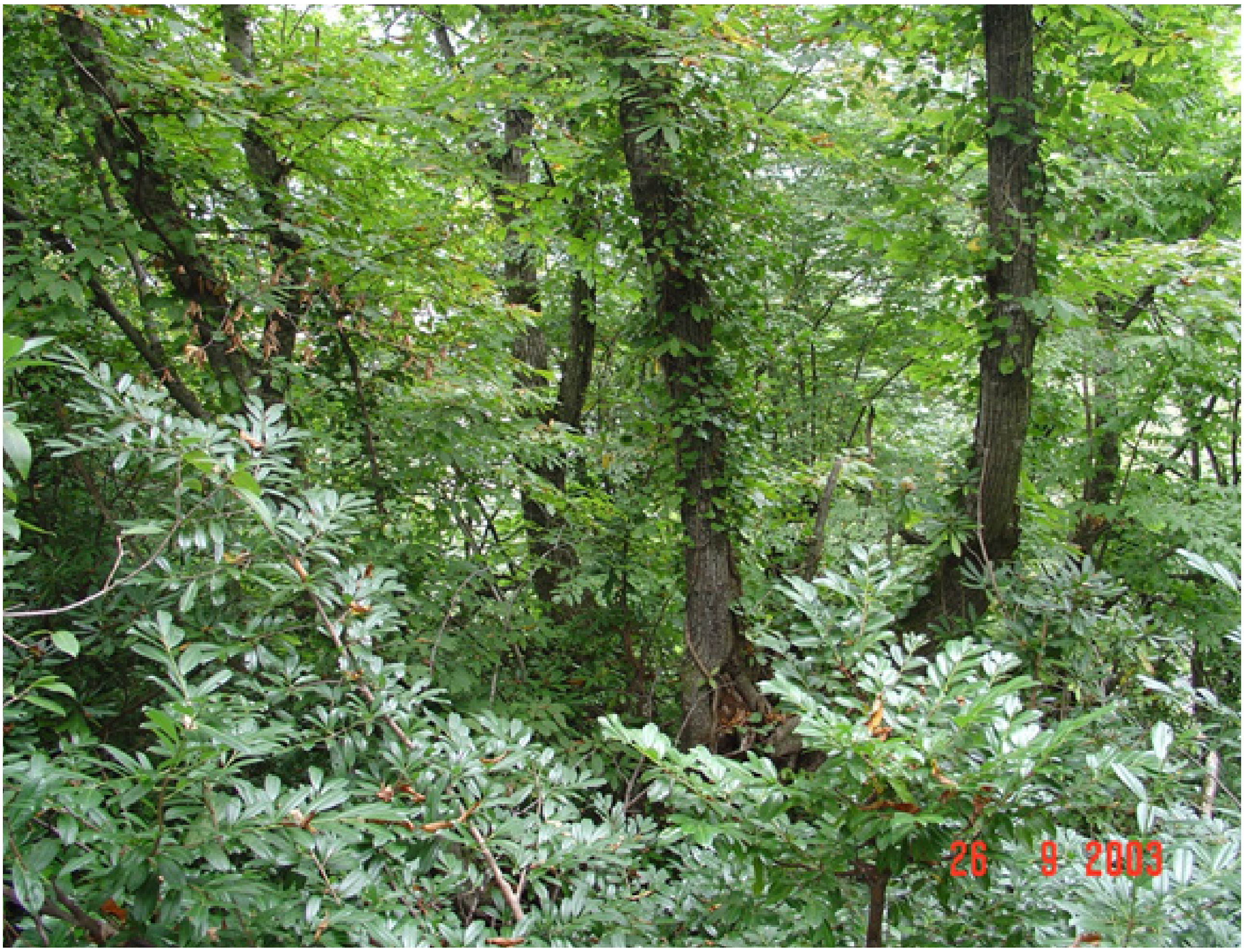

Figure 13. Castanetum laurocerasum, an example of Colchic forest with understorey of semi-prostrate evergreen shrubs, in the Collin-submontane belt of Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze).

The main concentration areas of these typical semi-prostrate Colchic relicts, in the Caucasus, and therefore the most typical Colchic rainforests, are found in the southern Colchic area (Dolukhanov 1980, Zazanashvili et al. 2000; see Figure 14), particularly on the territory of the Mtirala-Kintrishi nominated component area.

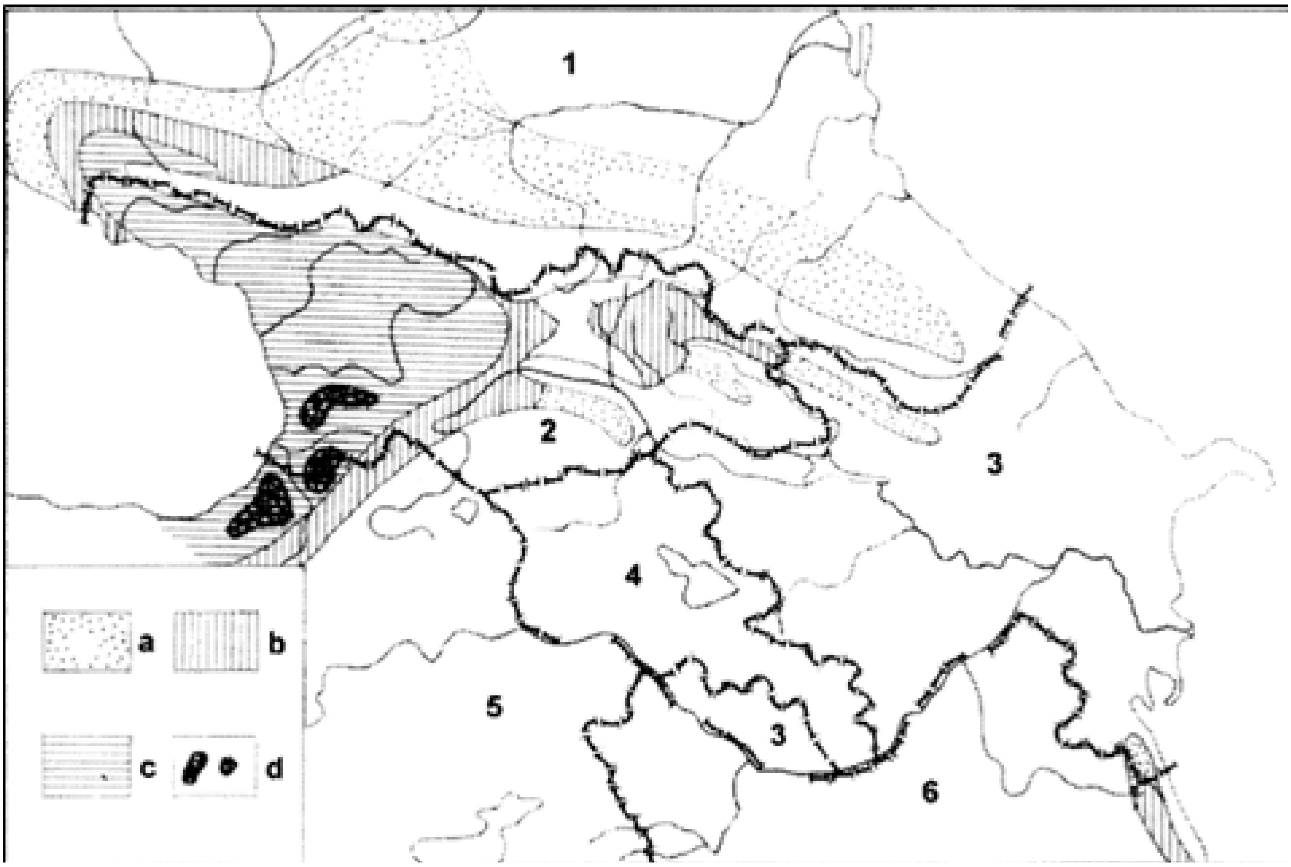

Figure 14. Distribution of semi-prostrate Colchic relicts in the Causasus: L*aurocerasus officinalis, Rhododendron ponticum, Rh. luteum, Rh. ungernii, Rh. smirnowii, Vaccinium arctostaphylos, Epigaea gaultherioides, Viburnum orientale, Ruscus colchicus, Ilex colchica, I. stenocarpa, I. hyrcana – including Rh. × sochadze* but excluding *Rh. causasicum.* a = areas with 1 - 2 species; b = 3 - 4 species; c = 5 - 8 species; d = 9 - 11 species (Dolukhanov, 1980). 1 = Russian Federation; 2 = Georgia; 3 = Azerbaijan; 4 = Armenia; 5 = Turkey; 6 = Iran (from Zazanashvili et al. 2010).

Classification of forest ecosystems, habitats and vegetation: Forest cover of the nominated component areas is characterized by a high diversity of types in dependence of altitudinal belts and site conditions (Figure 15). The list of forest types contains 23 associations in 5 formations (Appendix 4), based on the dominance of tree species. These associations form the following altitudinal complexes, which correspond with vegetation units of the Map of natural vegetation of Europe (Bohn et al. 2000):

A –Colchic lowland forest (0-25 m a. s. l.) is characterized by polydominant deciduous forest (Figure 16) with woody species of *Alnus glutinosa* subsp. *barbata, Pterocarya fraxinifolia,* endemic *Quercus hartwissiana*, *Fraxinus excelsior*, *Carpinus betulus, Acer orthocampestre,* with some individuals of *Zelcova carpinifolia and Fagus orientalis,* and shrubs *Viburnum opulus, Ficus colchica, Morus nigra,* with an evergreen understory of *Ilex colchica,* endemic *Buxus colchica* and creeping lianas, such as *Hedera colchica, Humulus lupulus, Periploca graeca, Lonicera caprifolia.*

At the lowest elevations at around sea level, very swampy alder dominanted forests with *Alnus glutinosa* subsp. *barbata* occur, mixed with some individuals of *Pterocarya fraxinifolia* occur.

B – The Collin-submontane belt (25-500 m a.s.l.) is characterized by the formations Carpineta and Castanetea: ***Carpinus betulus-Castanea sativa* mixed forests** with evergreen understorey of *Rhododendron ponticum, Laurocerasus officinalis, Ilex colchica* and with dominance of ferns in herbal layer (e.g*. Pteris cretica, Phyllites scolopendrium, Blechnum spicant, Athyrium felix-femina, Dryopteris filix-mas*) (Figure 17).

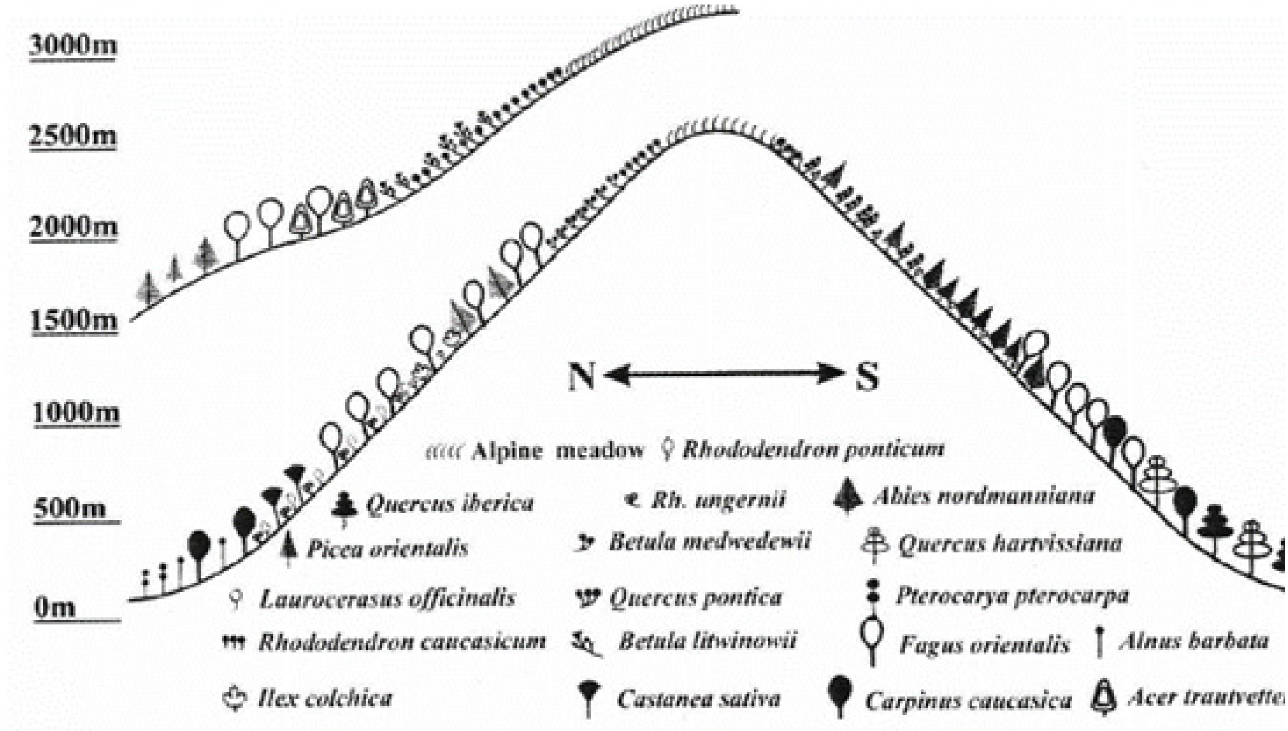

Figure 15. Vertical distribution of the vegetation types (the major species are given for forest types) in Ajara, southern Colchis (from Nakhutsrishvili 2013).

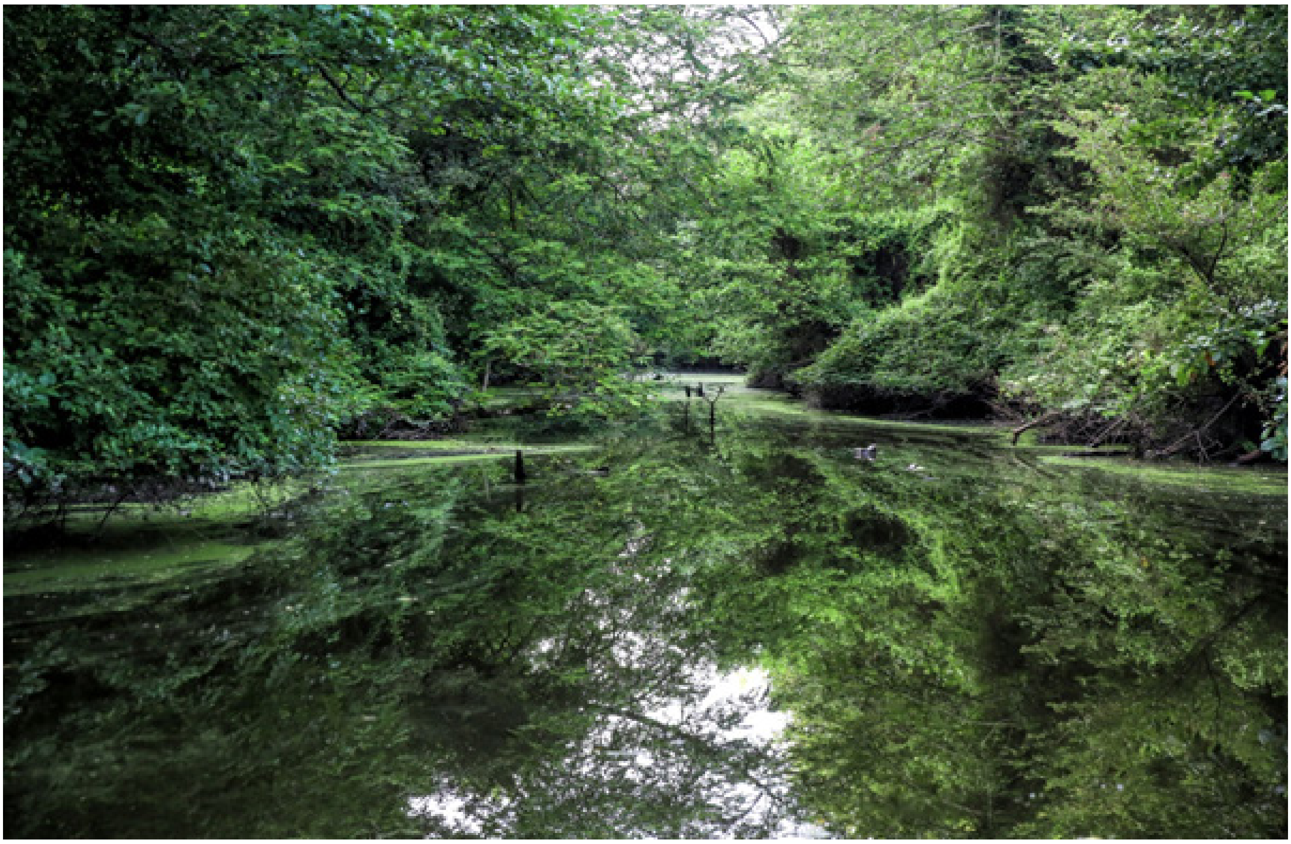

Figure 16. Colchic lowland forest and backwater at Pitshora nominated component area. (Photo: Paata Vardanishvili)

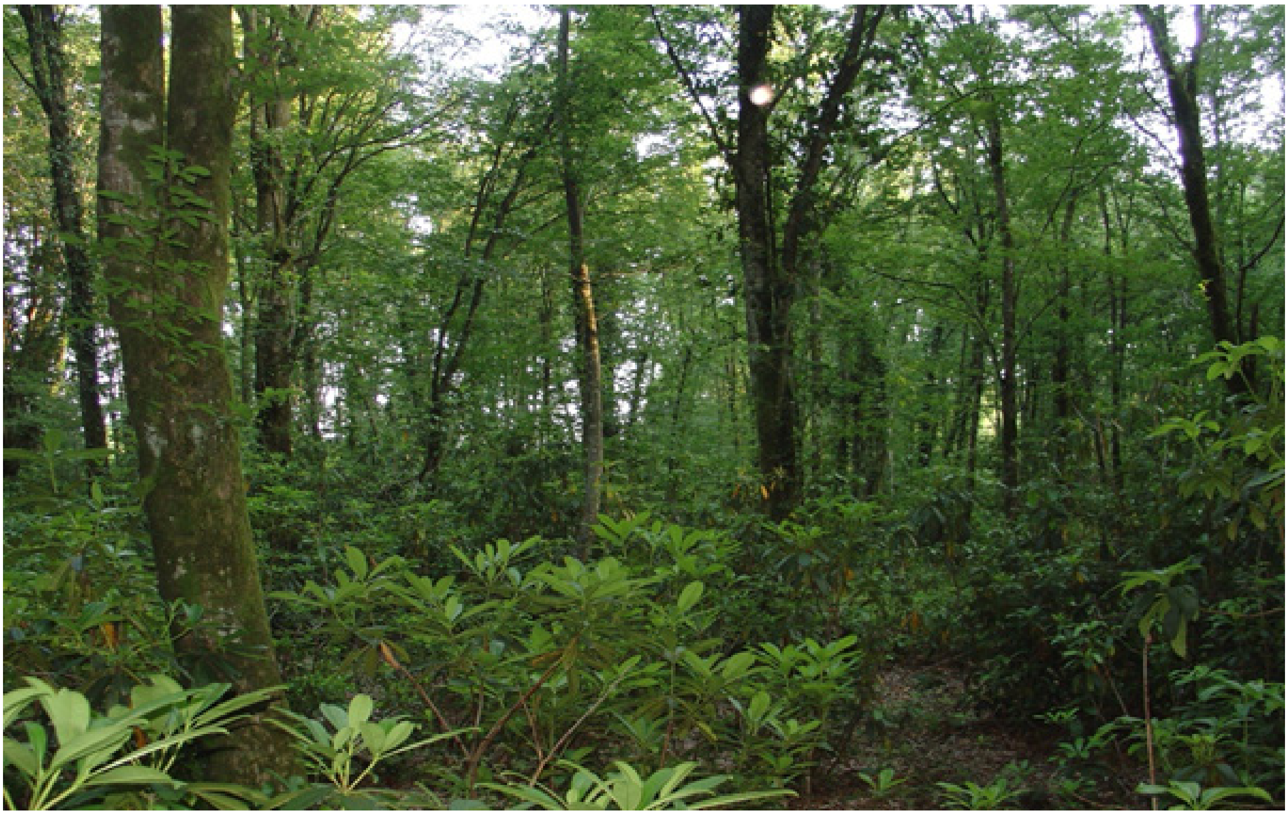

Figure 17. Carpinetum rhododendrosum in the collin-submontane belt of Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

Carpinetum rhododendrosum (1.1) and Fageto-Castaneto-Carpinetum rhododendrosum (1.2) only occur in this belt.

Castanetum rhododendrosum (2.1), Fageto-Carpineto-Castanetum laurocerasosum (2.5) and Castanetum laurocerasosum (2.3) connect this belt with the lower montane belt.

These types represent the **Hygro-thermophilous mixed deciduous broadleafd forests of the Colchis** (H 1) in the map of natural vegetation of Europe (Bohn et al. 2000).

C – The Lower montane belt (500-1,000 m a.s.l.) is characterized by the highest diversity of forest types and dominance of ***Castanea sativa-Fagus orientalis*** mixed forests with evergreen understory (Figure 18). While Castanetum rhododendrosum (2.1), Fageto-Carpineto-Castanetum laurocerasosum (2.5) and Castanetum laurocerasosum (2.3) connect this belt with the colline-submontane belt, Carpineto-Castanetum laurocerasosum (2.4), Fageto-Carpineto-Castanetum rhododendrosum (2.2), and Alnetum matteuccioso-rubosum (3.1) along rivers only occur in this lower montane belt.

Three associations of the Fageta formation have increasing share with increasing altitude. Fagetum nudum (4.12), Fagetum laurocerasosum (4.2) and Fagetum rhododendrosumn (4.1) start in the lower montane belt, but they are distributed until the middle montane belt and higher. The Alnetum sambucosum (3.2) is also described.

This diverse forest complex of the lower montane belt is described as **Euxinian hornbeam-chestnut-oriental beech forest** (*Fagus orientalis, Castanea sativas, Carpinus betulus*) with evergreen understory (F 169) in the map of natural vegetation of Europe.

D – The middle montane belt (1,000-1,800 m a.s.l.) is absolute dominated by **beech forests** (Figure 19)**.**

Fagetum laurocerasosum (4.2), Fagetum rhododendrosum (4.1) and Fagetum Rhododendroso-laurocerasosum (4.3) are the dominating beech forest associations with evergreen understory. Their also occur Fagetum arctostaphylosum (4.9).

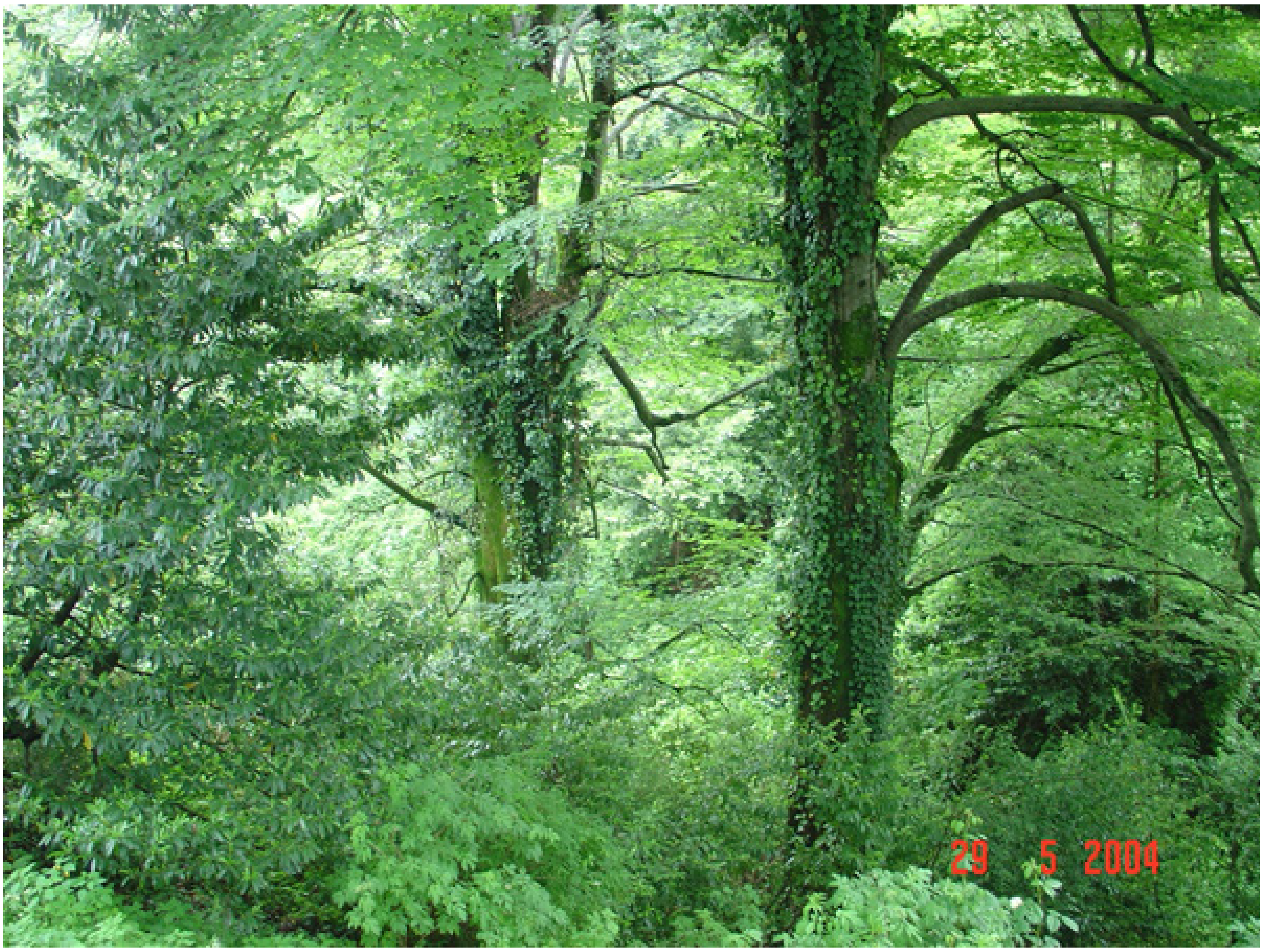

Figure 18. Fagetum-Castanetum-Carpinetum rhododendrosum in the lower montane belt of Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze).

Two further Fageta associations are described from Mtirala: Fagetum viburnosum (4.10) and Fagetum mixtofruticosum (4.11).

In the upper parts of this belt in Mtirala-Kintrishi nominated component area, Fagetum seneciosum (4.4) and Abieto- Fagetum seneciosum (4.5) with coniferous trees of *Abies nordmanniana* and *Picea orientalis* occur.

These associations are summarized as **Euxinian-Caucasian Oriental beech forests** (*Fagus orientalis*) mostly with evergreen understory (*Prunus laurocerasus, Rhododendron ponticum, Daphne pontica*), with *Hedera colchica, Ilex colchica, Ruscus colchicus* (F 163) in the Map of natural vegetation of Europe.

E – The upper montane belt (1,800-2,200 m a.s.l.) in the upper part of Mtirala-Kintrishi nominated component area is characterized by **mixed beech forests** with coniferous trees of *Abies nordmanniana* and *Picea orientalis*: Fagetum seneciosum (4.4), Fagetum graminoso-mixtoherbosum (4.6), Fagetum altherbosum (4.7) (Figure 20).

They are summarized as **West Caucasian fir, spruce-fir and beech-fir forests** with evergreen understory (D 32) in the map of natural vegetation of Europe.

The Betuleto-Fagetum caucasico-rhododendrosum (4.8) connects this belt with the following belt.

F – The subalpine forest line belt (2,200-2,500 m a.s.l.), which is formed by **birch forests** of *Betula litwinowii* and *B. medwedewii*: Betuleto caucasico-rhododendrosum (5.1) and Betuletum altherbosa subalpina (5.2). The Betuleto-Fagetum caucasico-rhododendrosum (4.8) forms the forest line at 2,400m a.s.l. with *Fagus orientalis, Betula litwinowii, B. medwedewii, Acer trautvetteri* and *Sorbus subfusca* (Figure 21).

This complex is described in the Map of natural vegetation of Europe as **Western Low Caucasian krummholz and open woodland** (C 45) in the subalpine belt.

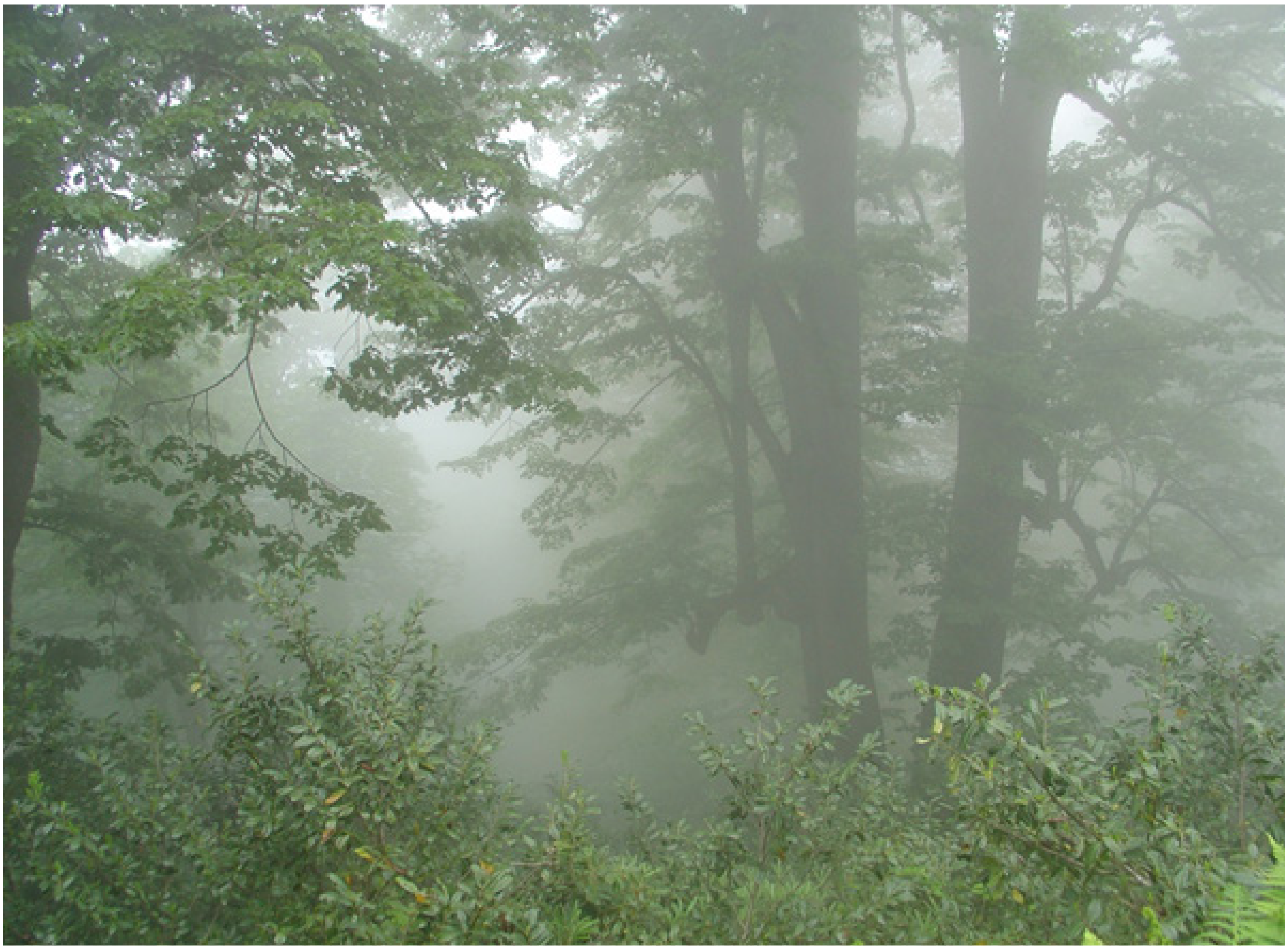

Figure 19. Fagetum laurocerasosum in the middle montane belt of Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

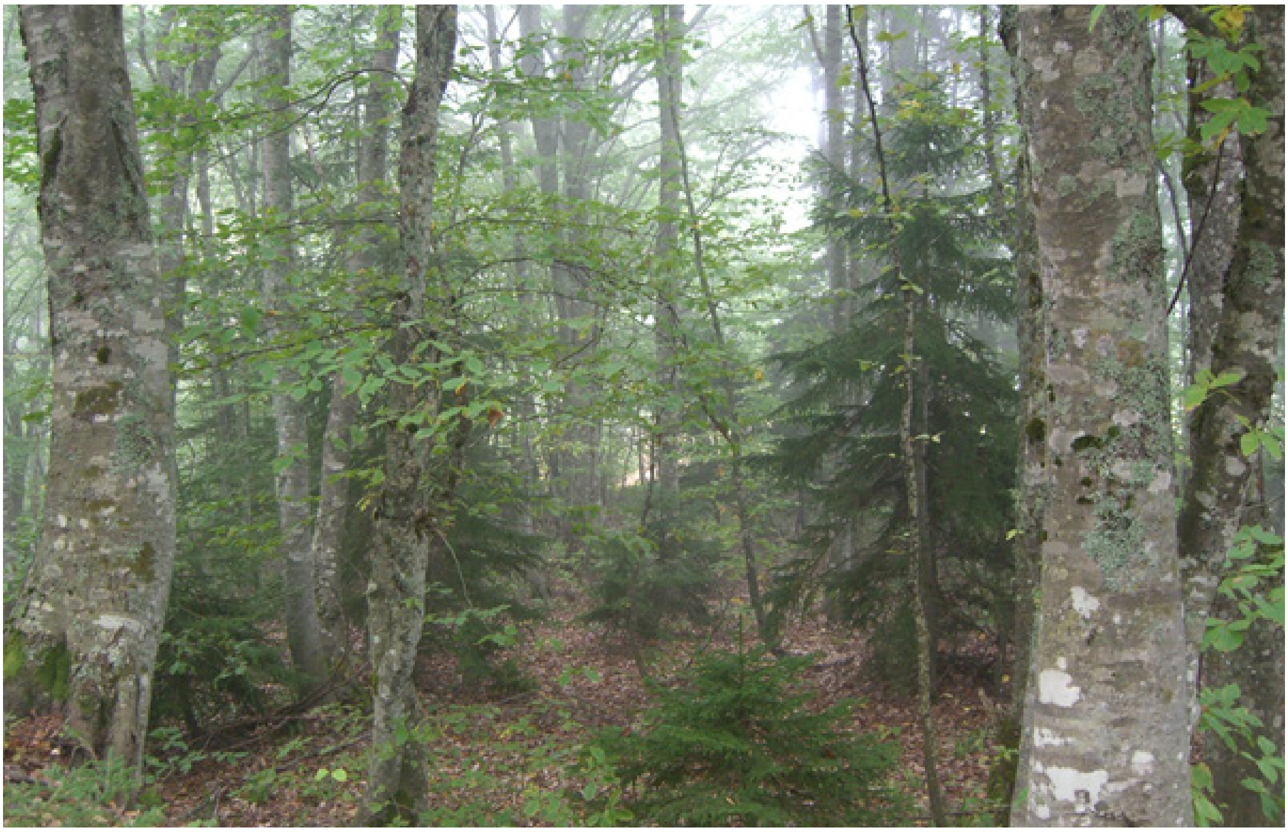

Figure 20. Abieto-Fagetum seneciosum in the upper montane belt of Mtirala-Kintrishi nominated component area.

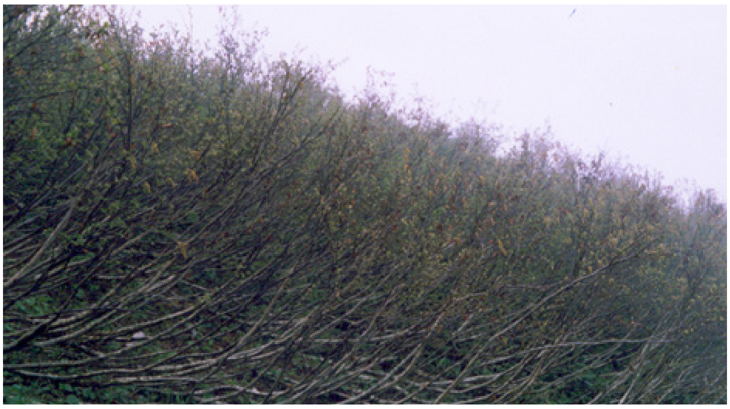

Figure 21. Betuletum altherbosa subalpina in the subalpine forest line belt of Mtirala-Kintrishi nominated component area. (Photo. Zurab Manvelidze)

G – The lower alpine grassland and thicket belt (2,400-2,750 m a.s.l.) frames the typical Colchic forest ecosystems above the tree line at the highest altitudes of Mtirala-Kintrishi nominated component area. It is characterized by grasslands (with *Nardus stricta*, *Festuca djimilensis*, *Agrostis lazica*, *Geranium gymnocaulon*), as well as *Rhododendron caucasicum* thickets (Figure 22).

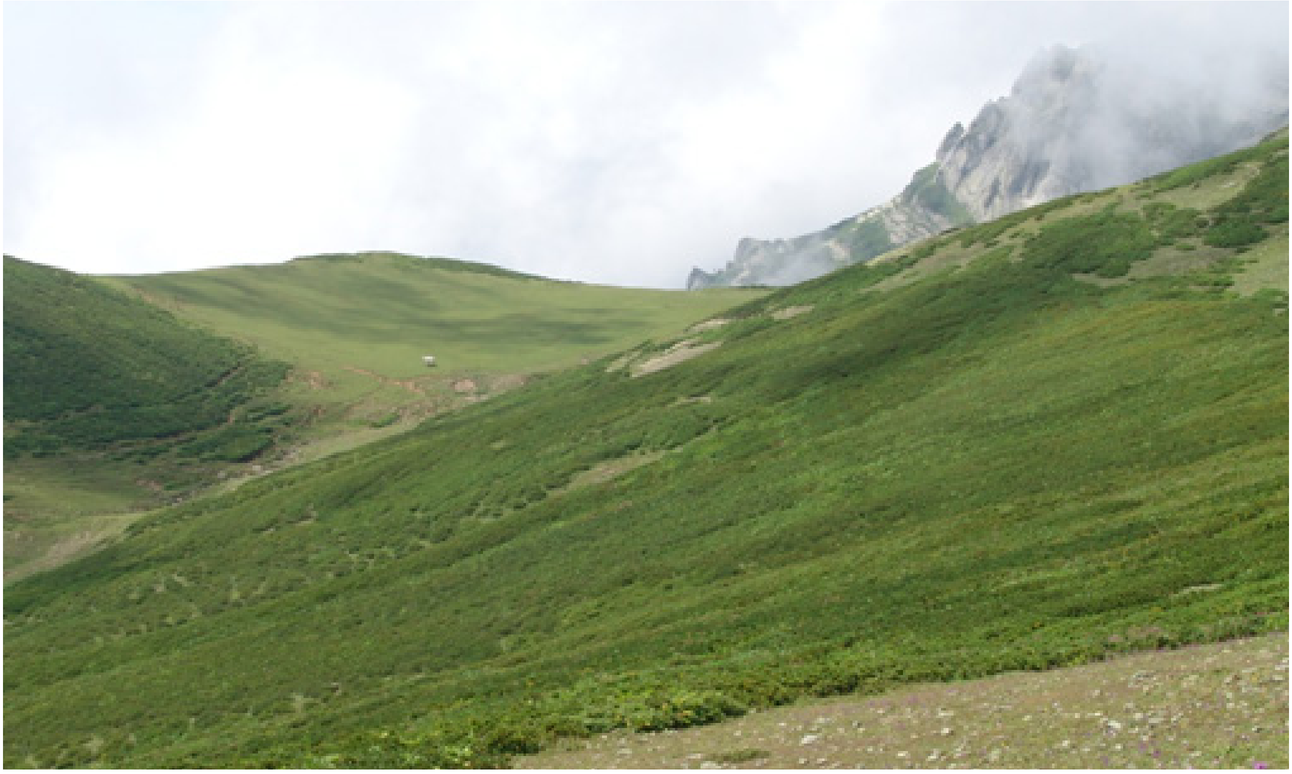

Figure 22. Rhododendrion subalpina, a typical plant association of upper Kintrishi valley, Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

This classification largely corresponds to the West Caucasus vertical zones as identified by Zazanashvili et al. (2000), and to the vertical zonation as illustrated by Nakhutsrishvili (2013) (Box 2, Figure 15).

Box 2. The East Caucasian type vertical zones as by Zazanashvili et al. (2000). The altitudes covered by the Colchic Forests and Wetlands are also shown.

IA. Humid thermophilous Colchic broad-leaved forest zone, up to 1,000(1,200) m a.s.l.

IA1. Mixed broad-leaved forest belt, up to 500-600 m a.s.l.

- Forests of *Castanea sativa, Carpinus caucasica, Fagus orientalis, Quercus hartwissiana* and *Zelkova carpinifolia,* with Colchic understorey including *Rhododendron ponticum, Laurocerasus officinalis* and *Ruscus colchicus* as well as the lianas *Hedera colchica, H. helix, Vitis sylvestris*;
- In relatively dry habitats thermophilous hornbeam-oak forests with *Quercus iberica, Carpinus caucasica* and *C. orientalis*;

- In southern Colchis (from 200 m upwards) pine-oak forests with *Quercus iberica, Q. dschorochensis* and *Pinus kochiana* as well as Colchic thickets with *Rhododendron ponticum, Ilex colchica, Laurocerasus officinalis* and *Ruscus colchicus*.

IA2. Chestnut forest belt, up to 500-1,000 (1,200) m a.s.l.

- *Fagus orientalis* forest often with a Colchic understorey;
- Dark coniferous and mixed beech-dark-coniferous forests (*Abies nordmanniana, Picea orientalis, Fagus orientalis*), partly with a Colchic understorey.
- Colchic thickets (see IA1, with *Rhododendron ponticum, Rh. ungernii, Laurocerasus officinalis, Ilex colchica, Ruscus colchicus, Vaccinium arctostaphylos, Viburnum orientale*)

IB. Humid beech forest zone, 1,000(800)-1,400(1,800) m a.s.l.

IIB2. Upper mountain belt, 1,500-1,900 (2000) m a.s.l.

- *Fagus orientalis* forests; *Quercus macranthera* forests
- *Pinus kochiana* forests and woodlands

IC. Nemoral humid coniferous forest zone, 1400(1,000)-1,800(2,100) m a.s.l.

- Forests with *Abies nordmanniana, Picea orientalis* and *Fagus orientalis*, partly with Colchic understorey.

ID. Subalpine elfin wood and meadow zone, 1,800(1,600)-2,400(2,700) m a.s.l.

ID1. Lower subalpine belt

- Beech, oak and birch elfin woods (*Fagus orientalis, Quercus pontica, Betula medwedewii, B. megrelica*), often with Colchic understorey;
- Tall herbaceous vegetation (*Heracleum ponticum, Ligusticum physospermifolium, Senecio cladobotrys*);
- *Rhamnus imeretina, Sorbus subfusca* or *Corylus colchica* thickets;
- Colchic thickets (*Rhododendron ponticum, Rh. ungernii, Laurocerasus officinalis, Ilex colchica, Ruscus colchicus, Vaccinium arctostaphylos*);
- Subalpine meadows (*Calamagrostis arundinacea, Poa iberica, Geranium platypetalum*).

ID2. Upper subalpine belt, 2,100-2,400(2,700) m a.s.l.

- Birch/ash-birch elfin woods with *Betula litwinowii, Sorbus caucasigena*;
- *Rhododendron caucasicum* thickets;
- Subalpine meadows on limestone (*Calamagrostis arundinacea, Festuca djimilensis*);
- *Woronowia speciosa, Carex pontica*.

IE. Alpine grassland and thicket zone, 2,400-2,900(3,000) m a.s.l.

IE1. Lower alpine belt, 2,400-2,750 m a.s.l.

- Grasslands (*Nardus stricta, Festuca djimilensis, Agrostis lazica, Geranium gymnocaulon*);
- *Rhododendron caucasicum* thickets.

IE2. Upper alpine belt, 2,750-2,900(3,000) m a.s.l.

- Grasslands (*Festuca supina, Kobresia schoenoides* and *Geranium gymnocaulon*);
- Mats (*Cerastium cerastoides, Ranunculus svaneticus, Potentilla crantzii*);
- Rock and scree vegetation

IF. Subnival zone, 2,900-3,700(4,000) m a.s.l.

- Open plant communities (*Cerastium polymorphum, Minuartia trautvetteriana, Saxifraga scleropoda*).

IG. Nival cryptogam zone. > 3700 m.

Description and classification peatland ecosystems, habitats and vegetation: Extensive parts of the Colchic Lowlands are wetlands (Figure 23), owing to the warm and wet climate and numerous rivers flowing from the Caucasus Mountains to the Black Sea. In particular vast areas adjacent to the Black Sea are paludified due to the continuous subsidence of the lowland in combination with high precipitation and backwater of the rivers flowing into the Sea. The main natural ecosystems of the Colchis lowland are peatlands, relict Colchic riparian forest, open freshwater areas, wet meadows, and coastal sand dunes (see Table 3). Peatlands and Colchic lowland forest, but also some of the other ecosystem types with their habitats and vegetation are represent-

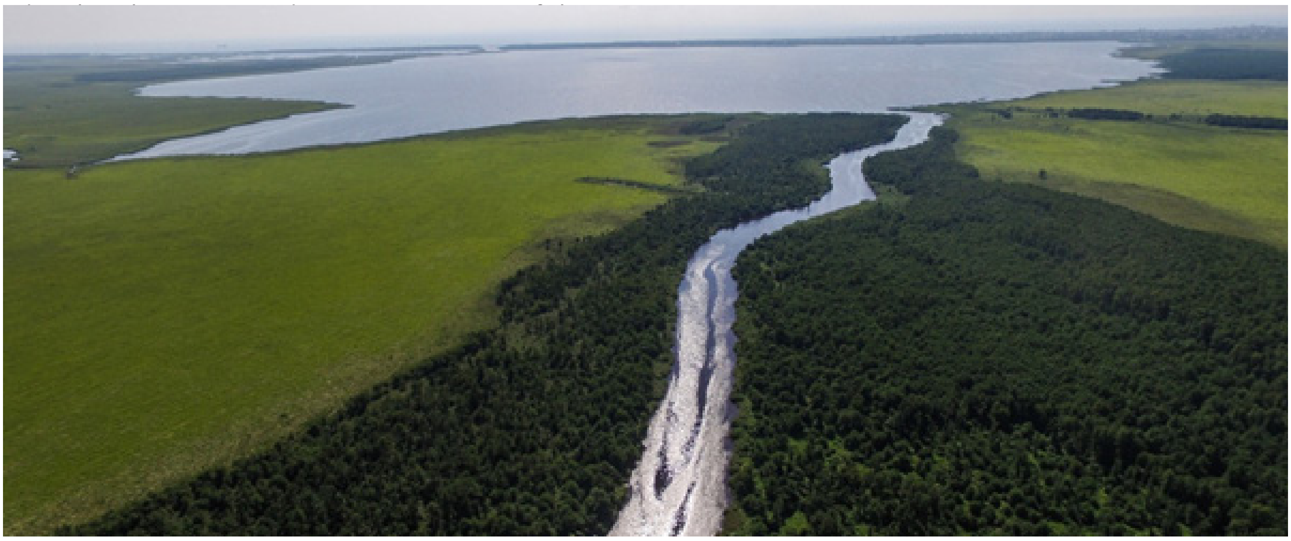

Figure 23. Aerial view of the Pitshora River with the Imnati (left) and Pitshora (right) nominated component areas of the Colchic Rainforests and Wetlands, showing mire and Colchic lowland forest areas. Note Lake Paliastomi and the Black Sea in the background. (Photo: Paata Vardanishvili)

Table 3. General overview over the distribution of main ecosystems, habitats and vegetation between the nominated component areas of the Colchic Rainforests and Wetlands. Habitats included into parts of the proposed property are marked with an asterisk (*), and those included into the proposed buffer zone with a double asterisk (**). Adapted from Matchutadze & Tsinaridze (2016).

Ecosystem/habitat	**Definition**	**Biodiv. value**	**Nominated component areas**
Forest			
All forest types other than the below*	Diverse – see text for details	High	Mtirala-Kintrishi
Relict riparian forest*	The relict riparian forests developed in the periphery of peatlands rich in endemic and relict tertiary species (*Pterocaria fraxinifolia, Quercus hartwissiana, Buxus colchic,a Ficus carica*) and *Carpinus betulus, Fraxinus excelsior, Humulus lupulus, Salix caprea.*	High	Imnati, Pitshora, Churia
Swamp alder forest* **	*Alnus glutinosa* subsp. *barbata* forms dense monospecific stands which show extremely low species richness. This could depend on the marshy feature of the site, with conditions of waterlogged subsoil all year round.	Low	Imnati, Pitshora, Churia
Sub-alpine & lower alpine			
Sub-alpine & lower alpine grassland and thickets* **	Grasslands (with *Nardus stricta, Festuca djimilensis, Agrostis lazica, Geranium gymnocaulon*), as well as *Rhododendron caucasicum* thickets.	High	Mtirala-Kintrishi
Peatland (mire)			
Percolation bog*	Fully ombrotrophic bogs.	High	Imnati, Ispani; transition forms at Pitshora, Grigoleti
Fen*	Fens – geogenous water	High	Churia, Nabada
Aquatic ecosystems			
Permanent freshwater* **	Channels with submerged plants such as: *Potamogeton sp. Ceratophylum demersum, Egeria denca* (as invasive species) by *Nymphaea alba, Nymphaea colchica, Nuphar lutea,* is *Trapa colchica, Trapa maleevi, Trapa hyrcana, Salvinia natans, Marsilea quadrifolia*	High	Imnati, Pitshora, Grigoleti, Nabada, Churia

Total current peatland area consists of approximately 17,000 ha peatland area and 30,000-50,000 ha wet forest with unknown extent of peat layers, with the majority situated in the Colchic Lowlands (Krebs et al. 2017). Globally extraordinary habitats in the Kolkheti lowland are the percolation bogs, which only exist here. The diversity of peatlands and partly still pristine mires in this ancient cultural landscape is remarkable (Joosten et al. 2003).

The Colchic wetlands are characterized by a high diversity of ombrotrophic, *Sphagnum*-dominated and minerotrophic, *Carex*-dominated peatlands (e.g. Joosten et al. 2003, Kimeridze 1999, Krebs et al. 2017). This diversity can be structured based on a broad successional classification: The peatlands of Churia and Nabada nominated component areas are dominated by sedge vegetation and represent a bog development stage preceding the development of percolation bogs, the so-called water rise mires. Water rise mires are dependent on the water table of the adjacent groundwater for peat formation and thus - in the case of the Colchis - provide valuable palaeoecological information on the changes in the (relative) Black Sea water level through time. Several remarkably old, continuously-accumulated water rise mires are among the proposed component areas (e.g. Nabada, which dates back 7,000 years ago). This is owing to the slow and constant subsidence of the Colchis lowland (in Central Colchis with c. 5.5-6.5 mm per year, Svanidze 1989) and a gradual, long-term slow increase of the Black Sea water table. The mires of Grigoleti and Pitshora nominated component areas are already characterized by a relatively high contribution of Sphagnum mosses and can be considered percolation bogs *in statu nascendi.* The peatlands at Imnati and Ispani nominated component areas are the only fully developed percolation bogs found worldwide, with that of Imnati being significantly larger and older than that of Ispani 2 (Figure 24).

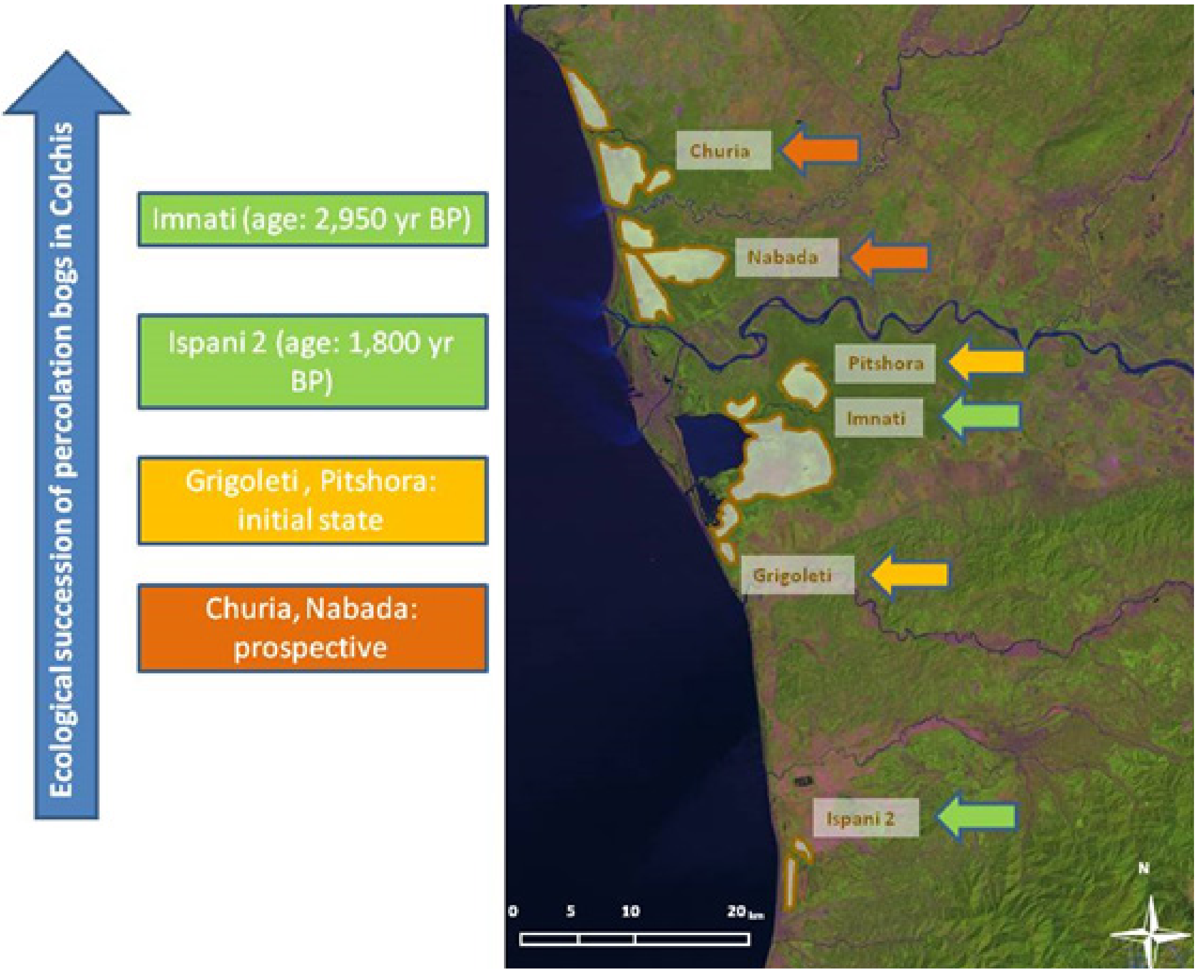
Ecological succession of percolation bogs in Colchis
Imnati (age: 2,950 yr BP)
Ispani 2 (age: 1,800 yr BP)
Grigoleti , Pitshora: initial state
Churia, Nabada: prospective
Churia
Nabada
Pitshora
Imnati
Grigoleti
Ispani 2
N
0
5
10
20 km

Figure 24. Successional relationships between the peatlands of the nominated component areas of Ispani, Grigoleti, Imnati, Pitshora, Nabada and Churia. (Source: Matthias Krebs, pers. comm.)

Description of other wetland ecosystems, habitats and vegetation: The peatlands of the Colchic Lowlands are accompanied not only by Colchic lowland forests but also by other types of wetlands including **freshwater ponds and streams** (Figure 25) and coastal dunes. Freshwater ponds are inhabited by species such as *Trapa colchica, Trapa natans, Trapa hyrcana, Salvinia natans, Ceratophyllum demersum, Ceratophyllum submersum,* and *Potamogeton natans. Salvinia natans* only exists in such systems in the Colchic Lowlands. There is also *Typha minima.* Freshwater ponds are interspersed with other habitats of the proposed property in all lowland component areas and also occur in the proposed buffer zone. The buffer zone (but not the nominated property) also includes coastal sandy dunes and has preserved its original appearance in the north-western coastal stripe between the areas of the mouths of the Churia and Khobistskali rivers, Maltakva and Grigoleti beach, and along the Choloqi coast line. On the sandy substrata of this narrow strip, periodically salted by seawater, typical littoral, bulb, perennial xerophytes, xerophytes shrubs and ephemeral vegetation formations sharply distinct from each other are developed.

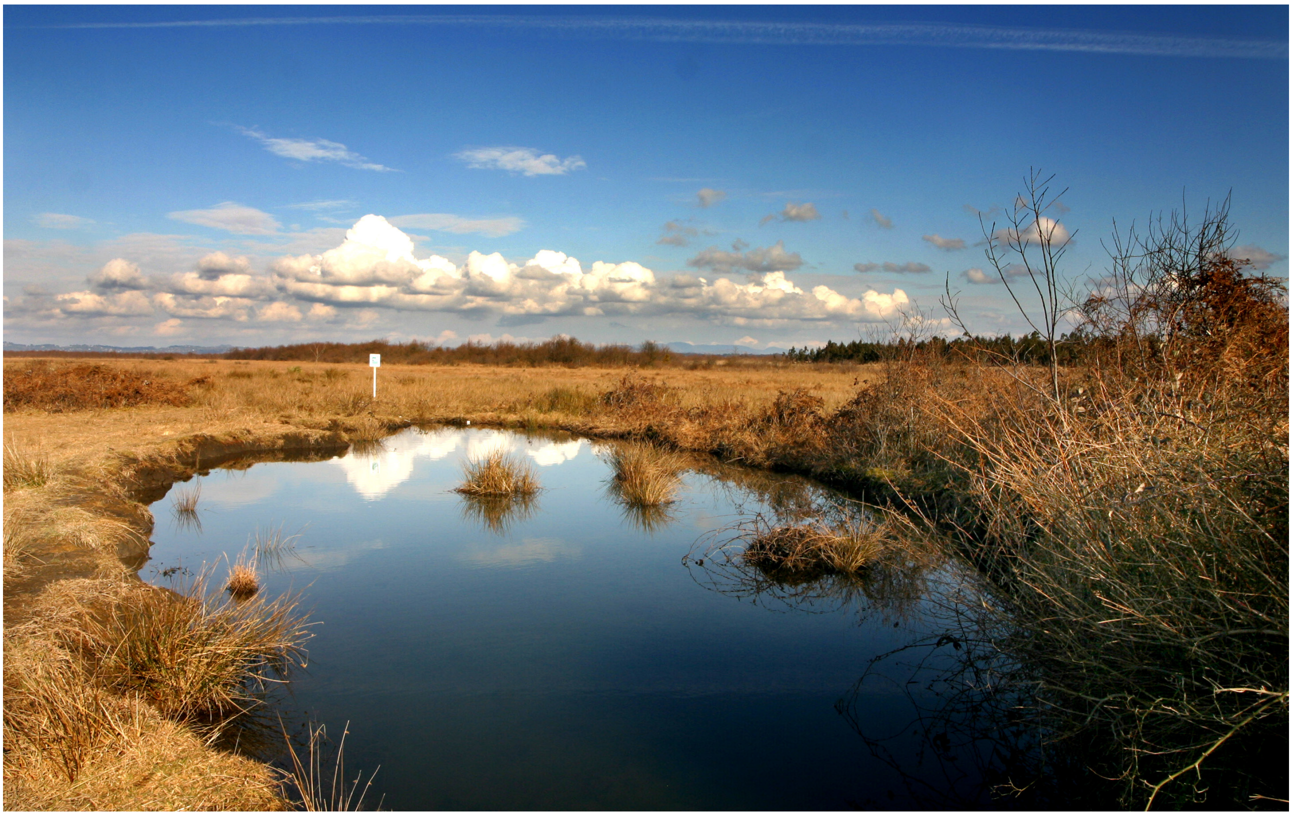

Figure 25. Freshwater pond at Ispani nominated component area, in the Colchic Lowlands. (Photo: Izolda Matchutadze)

Flora

The Colchis region is of one of the most important refugia of the flora and vegetation of the Tertiary and centre of biodiversity in western Eurasia, along with the Hyrcan region located in the southern coastal area of the Caspian Sea (Knapp 2005b). Many plants there have ancient boreal affinities (Nakhutsrishvili et al. 2010). Tertiary relict floras contain glaciation survivors from plant communities that were distributed in the Northern Hemisphere in the Tertiary, the first period of the Cenozoic era, now mainly restricted to warm humid areas (refugia) in southeastern and western North America, East Asia and southwest Eurasia (Milne and Abbott, 2002).

Among the nominated component areas of the Colchic Rainforests and Wetlands, Mtirala-Kintrishi nominated component area protects the major forest types and associated ecosystems with their flora (> 900 species). The other nominated component areas in the Colchic Lowlands protect peatlands, lowland forests and associate ecosystems and contain an additional 200 species, which brings the overall species count of vascular plants and bryophytes to > 1,100 (Table 4, Appendix 2). They include 37 pterophytes, 8 gymnosperms and ca. 1,050 angiospermes. About 220 of the flora of these areas and their surroundings are listed as Caucasus endemics by Solomon et al. (2014).

A high number of wooden plants underline the importance of forest ecosystems in the plant cover of the region. The list contains 48 tree species, 65 shrub species and 19 species that can grow as shrub or tree, as well as 7 lianas, i.e. 139 wooden species in total. The high number of perennial plants (706 species) also reflects the mature forest ecosystems of the series.

From a **plant-geographical** point of view, the Colchic forest flora is characterized by typical nemoral deciduous forest distribution patterns with low influence of boreal coniferous forest elements. Representatives of tree **genera** like *Quercus, Fagus, Castanea, Carpinus, Tilia, Ulmus* characterize the forests as part of the Holarctic deciduous forest regions, which are distributed in humid-(semihumid) parts of the nemoral zone in Eastern North-America, Europe-West-Asia and East-Asia. A high number of deciduous forest species demonstrate closer relations to European and Caucasian deciduous forests:

- Trees: e.g. *Acer campestre, A. platanoides, Carpinus betulus, Fraxinus excelsior, Ulmus glabra, Cerasus avium, Alnus glutinosa, Taxus baccata;*
- Shrubs: e.g. *Corylus avellana, Euonymus europaea, Ribes alpinum, Daphne mezereum, Viburnum opulus, Sambucus nigra;*
- Circumpolar distributed pterophytes (ferns): *Matteucia struthiopteris, Athyrium filix-femina, Dryopteris filix-mas, Dryopteris carthusiana, Gymnocarpium dryopteris, Polypodium vulgare, Huperzia selago, Diphasium alpinum, Lycopodium clavatum, Polystichum lonchitis, Asplenium trichomanes, A. viride;*
- Circumpolar distributed forest and mire plants: e.g. *Populus tremula, Sorbus aucuparia, Chamaenerion angiuistifolium, Oxalis acetosella, Vaccinium myrtillus, V. vitis-idaea, V. uliginosum, Pyrola media, P. minor, P. rotundifolia* and the mire plants *Drosera rotundifolia, Carex lasiocarpa, Menyanthes trifoliata, Rhynchospora alba.*
- European oceanic pterophytes (ferns): *Equisetum telmateija, Blechnum spicant, Asplenium adianthum-nigrum, A. septentrionale, Phyllitis scolopendrium;* to this distribution type also *Carex pendula;*
- Perennial herbs, which are common in European deciduous forests: *Sanicula europaea, Actea spicata, Stellaria holostea, Galiium odoratum, Galeobdolon luteum, Circaea lutetiana, Impatiens noli-tangere, Polygonatum multiflorum, Allium ursinum, Hordelymus europaeus, Carex sylvatica, C. remota, C. digitata, Cephalanthera damasonium, Epipactis helleborine, Neottia nidus-avis;*
- Perennial herbs, which connect mainly with Balcanic and Carpathian montane forests: *Petasites albus, Dentaria bulbifera, D. quinquefolia, Euphorbia amygdaloides, Salvia glutinosa, Telekia speciosa;*
- Thermophilous forest plants, which are wider distributed in southern (and South-Central) Europe: Trees such as *Carpinus orientalis*, *Ficus carica, Morus alba, M. nigra;* Shrubs such as *Mespilus germanica, Staphylea pinnata, Viburnum lantana;* Lianas such as *Periploca graeca, Clematis vitalba, Vitis sylvestris, Smilax excelsa;*
- The Colchis is part of the **Euxinian plant-geographical province**, which is characterized by e.g. evergreen shrubs like *Rhododendron ponticum, Laurocerasus officinale, Vaccinium arctostaphylos, Hypericum adzharicum* (Figure 26)*, Daphne pontica, but* also by tree species like *Fagus orientalis, Acer laetum, Tilia begoniifolia,* and *Pterocaria fraxinifolia (*Figure 27)
- These deciduous trees, as well as the relic trees *Zelkova carpinifolia* and *Diospyros lotus* connect the Colchic forests with **the Hyrcanian forests** in the south of the Caspian Sea. The endemic evergreen trees/shrubs *Buxus colchica* and *Ilex colchica,* as well as the liana *Hedera colchica* (Figure 28) are also related to species of the Hyrcanian forests, such as *Buxus hyrcana*, *Ilex spinigera* and *Hedera pastuchovii* (Knapp 2005b).

The majority of the Caucasus **endemic species** of the Colchic Rainforests and Wetlands are present in Mtirala-Kintrishi nominated component area, while the other nominated component areas contain a much lower number of the regional endemics: there are ten endemic species in Ispani nominated component area and another ten in the remaining five nominated component areas belonging to Kolkheti National Park, taken together (Table 4, Appendix 2). In view of in general wide global distribution of freshwater species, a high number of endemics are not expected to be present in local wetlands. The conservation value of the wetland

PAs should be assessed by their capacity to protect remnants of the Colchis wetland ecosystems, which also contain locally distributed endemic species. These include *Hibiscus ponticus* Rupr., a local endemic, which is listed as Critically Endangered, and *Solidago turfosa*, another local endemic which is listed as Endangered (Solomon et al. 2014) (Table 5).

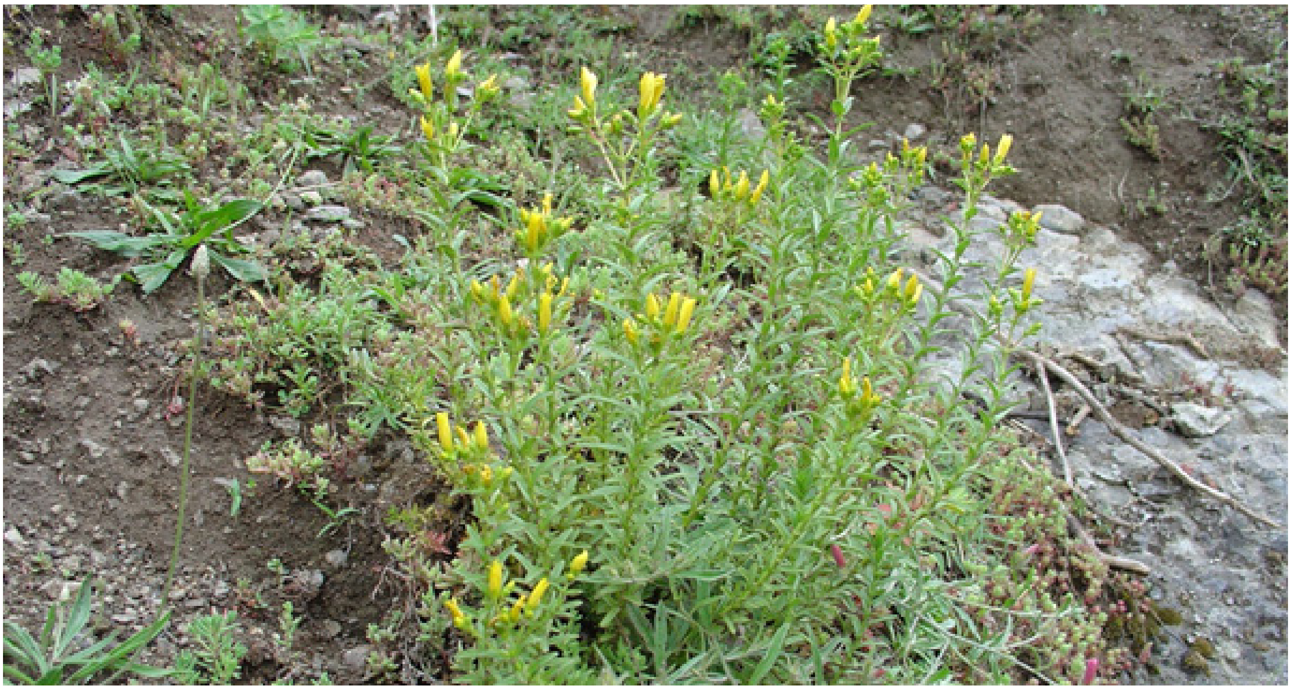

Figure 26. *Hypericum adzharicum*, a typical evergreen shrub species of the Euxinian plant-geographical province, at Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

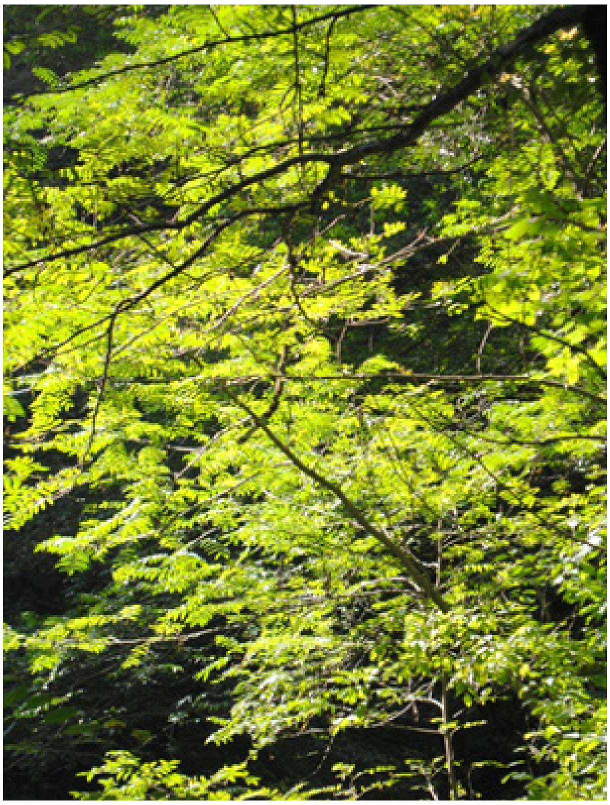

Figure 27. *Pterocarya fraxinifolia*, a typical tree species of the Euxinian plant-geographical province, at Churia nominated component area. (Photo: Nino Davitashvili)

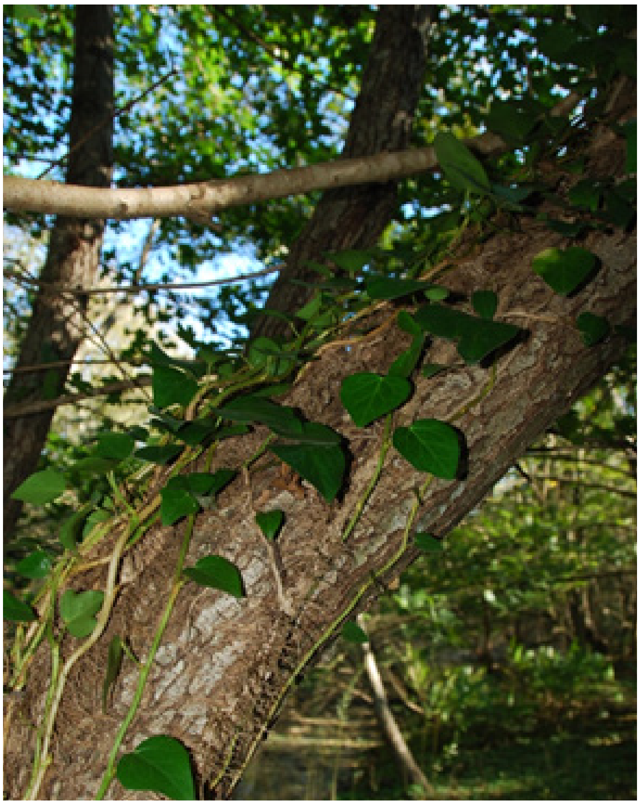

Figure 28. *Hedera colchica,* an endemic liana of the Colchic region, at Churia nominated compoment area. (Photo: Tobias Garstecki)

Table 4. Overall species richness of mosses and vascular plants and species richness of plant species with a restricted range in the seven nominated component areas of the Colchic Rainforests and Wetlands. (Source: Appendix 2).

	Mtirala-Kintrishi	Ispani	Grigoleti	Imnati	Pitshora	Nabada	Churia	**All**
Species No.	906	261	36	101	69	70	228	1,108
Number of species with ranges restricted to:								
Caucasus	65	3	2	3	2	1	2	66
Georgia	17	2	0	0	0	0	0	17
Colchis	52	2	2	2	4	1	3	54
Adjara-Lazetian	12	0	0	0	0	0	0	12

Table 5. Threatened and near-threatened vascular plant species of the Colchic Forests and Wetlands. Those species already listed on the Red List of the Caucasus endemic plant species are in the process of also being entered on the (global) IUCN Red List. Sources: Red List of Georgia (2014); Solomon et al. (2014), IUCN Red List of Threatened Species (2016).

#	Species	Kintrishi-Mtirala	Kolkheti areas[1]	Kobuleti	Component areas with species[1]	The IUCN Red List of Threatened Species (Assessment year)	The Red List of the Caucasus endemic species (2014)	The Red List of Georgia (2014)
1	*Arafoe aromatica* M.Pimen. & Lavrova	1			1		VU B1ab(ii)+2ab(ii)	
2	*Astragalus doluchanovii* Manden.*	1			1		VU D2	
3	*Betula medwediewii* Regel*	1			1	DD (2014)	VU B1ab(iii,v)	VU
4	*Buxus colchica* Pojark.	1	1		2	Lower Risk/near threatened (1998)		VU
5	*Castanea sativa* Mill.	1			1	LC (2017)		VU
6	*Cerastium oreades* Schischk.	1			1		NT	
7	*Chaerophyllum astrantiae* Boiss.& Bal.	1			1	NT (2008)	NT	
8	*Dactylorhiza euxina* (Nevski) Czerep.	1			1	NT (2008)		
9	*Daphne albowiana* Woronow ex Pobed.	1			1		EN B2ab(iii)	EN
10	*Epigaea gaultherioides* (Boiss. & Bal.) Takht.*	1		1	2		VU B2ab(iii)	VU
11	*Epimedium colchicum* (Boiss.) Trautv.*	1			1		NT	
12	*Galanthus krasnovii* A. Khokhr.*	1			1		EN B2ab(iii,v)	
13	*Grossheimia polyphylla* (Ledeb.) Holub.*	1			1		NT	
14	*Hibiscus ponticus* Rupr.*		1		1		CR C2a(i)	
15	*Juglans regia* L.	1			1	LC (2017)		VU
16	*Laserpitium affine* Ledeb.*	1			1		EN B1ab(iii)+2ab(iii)	

17	*Laurus nobilis* L.	1			1	LC (2017)		VU
18	*Myosotis lazica* M.Pop.*	1			1	NT (2008)	NT	
19	*Onobrychis meschetica* Grossh.	1			1	NT (2008)	NT	
20	*Oxytropis lazica* Boiss.	1			1		NT	
21	*Onobrychis kemulariae* Chinth.	1			1		VU D2	
22	*Osmanthus decorus* (Boiss.& Ball.) Kas.*	1			1		VU B2ab(iii)	VU
23	*Paederotella pontica* (Rupr.exBoss.) Kem-Nath.*	1			1		VU B2ac(ii)	
24	*Paeonia macrophylla* (Albov) Lomak.*	1			1		VU B1ab(iii,v)	
25	*Psephellus adjaricus* (Albov) Grossh.*	1			1	CR B2ab(iii,v) (2008)	CR B2ab(iii,v)	
26	*Quercus hartwissiana* Steven	1	1		2	DD (2017)		VU
27	*Quercus imeretina* Steven ex Woronow*	1		1	2		VU B2ab(iii)	VU
28	*Quercus pontica* K.Koch*	1		1	2		VU B2ab(iii)	VU
29	*Ranunculus vermirrhizus* Khokhr.	1			1		CR B1ab(i,ii,iii)+2ab(i,ii,iii)	
30	*Rhododendron ungernii* Trautv.*	1			1		VU B1ab(iii)	VU
31	*Rhynchospora caucasica* Palla*		1	1	2		EN B2ab(iii)	
32	*Senecio pandurifolius* C.Koch	1			1		NT	
33	*Salix kikodseae* Goerz*	1			1		VU	VU
34	*Scabiosa adzharica* Schchian.*	1			1	EN B1ab(iii)+2ab(iii) (2008)	EN B1ab(iii)+2ab(iii)	
35	*Solidago turfosa* Woronow ex Grossh.*		1	1	2		EN B2ab(iii)	
36	*Staphylea colchica* Steven*	1			1		VU A2c; B1ab(iii)+2ab(iii)	VU
37	*Swida koenigii* (C.K. Schneid.) Pojark. ex Grossh.*	1			1		VU B2ab(iii)	
38	*Trapa colchica* Albov*		1		1	CR C2a(i) (2008)	CR C2a(i)	
39	*Trapa maleevii* V.N.Vassil.*		1		1	VU D2 (2008)	VU D2	
40	*Tripleurospermum szowitzii* (DC.) Pobed.	1			1		VU D2	
41	*Ulmus glabra* Huds.	1			1	DD (2017)		EN
42	*Verbascum adzharicum* Gritzenko	1			1		VU D2	
43	*Viola orthoceras* Ledeb.*	1			1		VU B1ab(iii)+2ab(iii)	
44	*Zelkova carpinifolia* (Pall.) K. Koch		1		1	VU A2cd (2018)		VU
	Number of species per component area	38	8	5				

[1] In this analysis, the five component areas within Kolkheti National Park are treated jointly as one component. See Appendix 2 for occurrence of species in individual component areas.

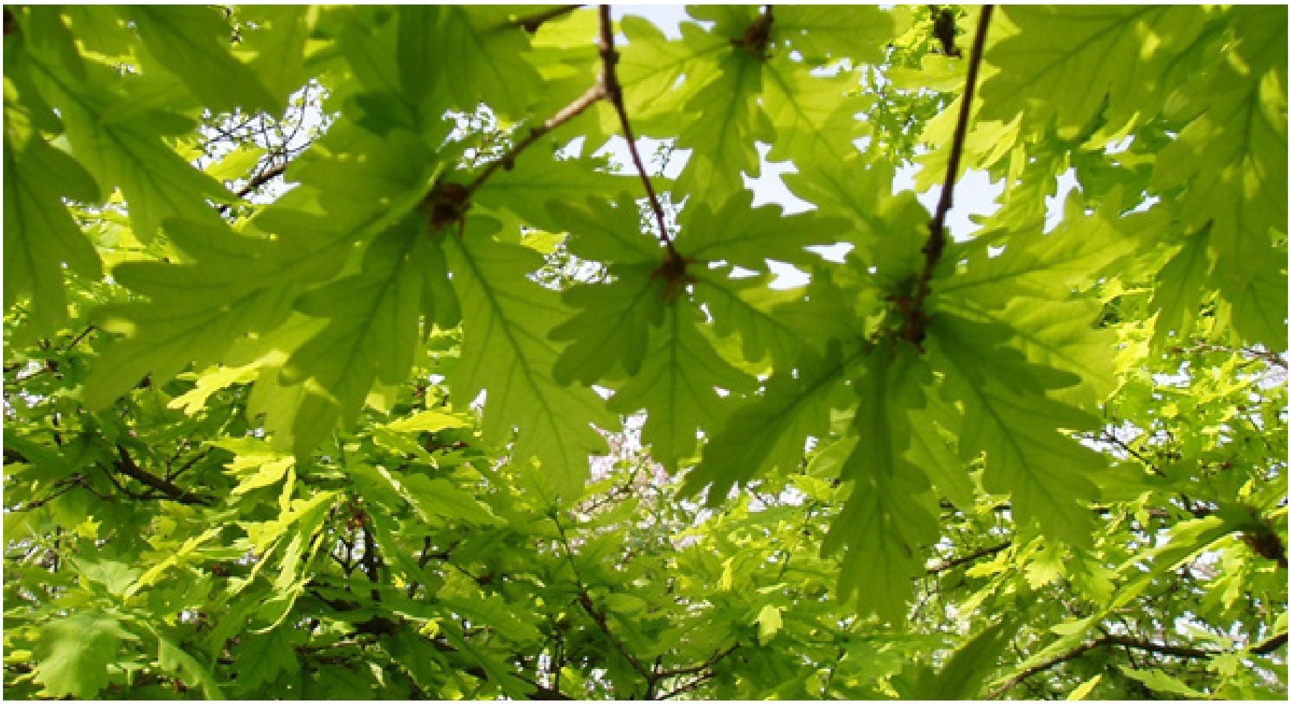

Figure 29. *Quercus imeretina,* a tree species of the Colchic Forests and Wetlands that is endemic to the Caucasus. (Photo: Ketevan Batsatsashvili)

The largest group of endemics are Caucasian species (82 species including Georgian endemics). The second group are Colchic endemics (52 species), and the third Adjara-Lazetian/Adjaraian endemics (12) (Memiadze et al. 2013). ***Caucasian and Georgian endemics*** demonstrate the close evolutionary relation of the Colchis with the whole Caucasus region, e.g. the trees *Acer trautvetteri, Quercus imeretina* (Figure 29)*, Pyrus caucasica, Betula litwinowii,* the perennial herbs *Primula pseudoelatior, Symphytum caucasicum, Helleborus caucasica, Galanthus woronowii, Atropa caucasica, Verbascum adsharicum, Digitalis schischkini* and a lot of other herbs. ***Colchic endemics*** are e.g. *Betula medwedewii, Quercus pontica* (Figure 30)*, Sorbus subfusca, Sorbus colchica, Rhamnus imeretica,* the perennial herb *Paeonia macrophylla* and the geophytes *Galanthus krasnovii* (Figure 31)*, Ornithogalum woronowii, Scilla winogradowii.* ***Adjara-Lazetian and Adjarian endemics*** are the most specific taxa with the only populations worldwide in this region, e.g. *Quercus dschorochensis, Phyllirea medwedewii, Rhododendron ungernii* (Figures 1, 32)*, Epigaea gaultherioides,* and *Cyclamen adsharicum.* (Figure 33)

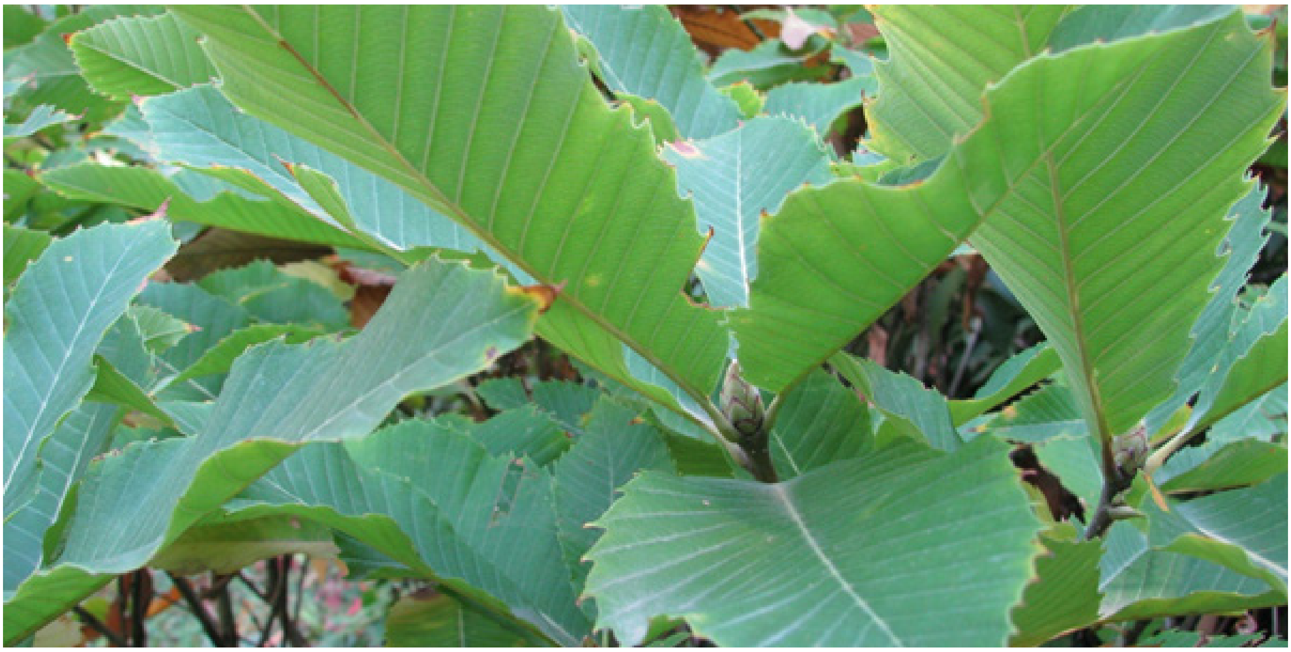

Figure 30. *Quercus pontica,* a tree species of the Colchic Rainforests and Wetlands that is endemic to the Colchic region. (Photo: Ketevan Batsatsashvili

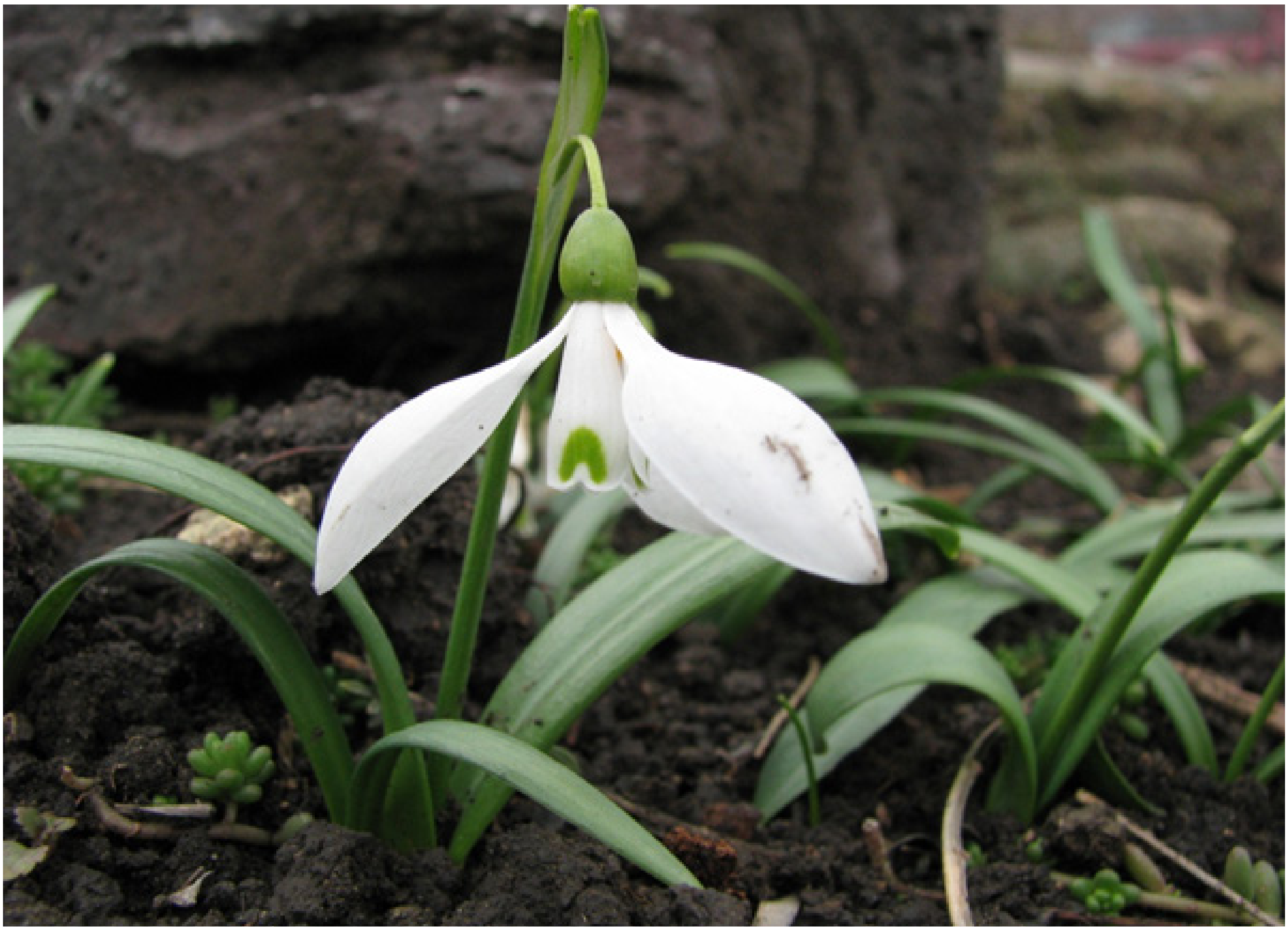

Figure 31. *Galanthus krasnovii,* a species of the Colchic Rainforests and Wetlands that is endemic to the Colchic region. (Photo: Ketevan Batsatsashvili)

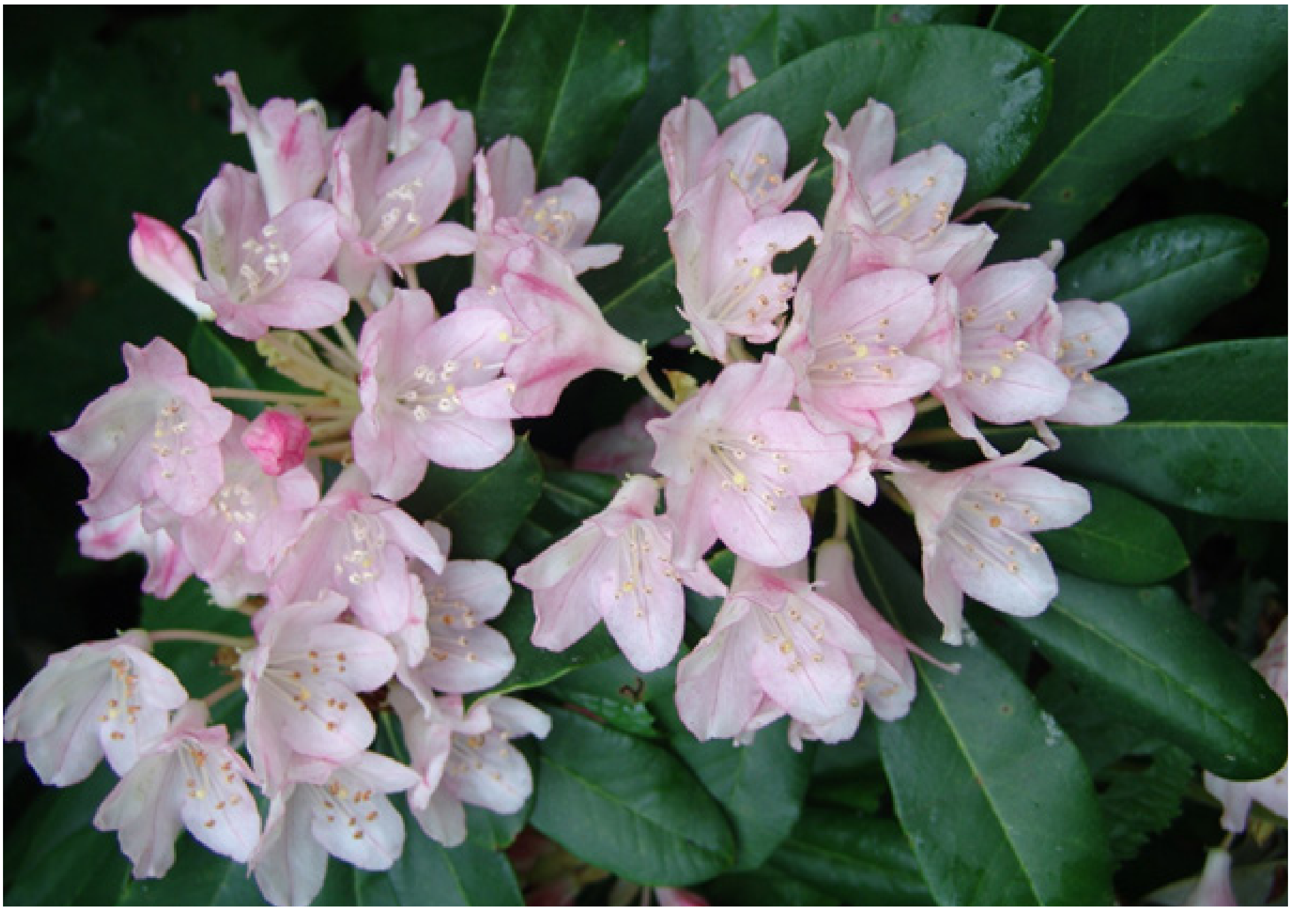

Figure 32. The rare Ajara-Lazeti endemic *Rhododendron ungernii* at Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

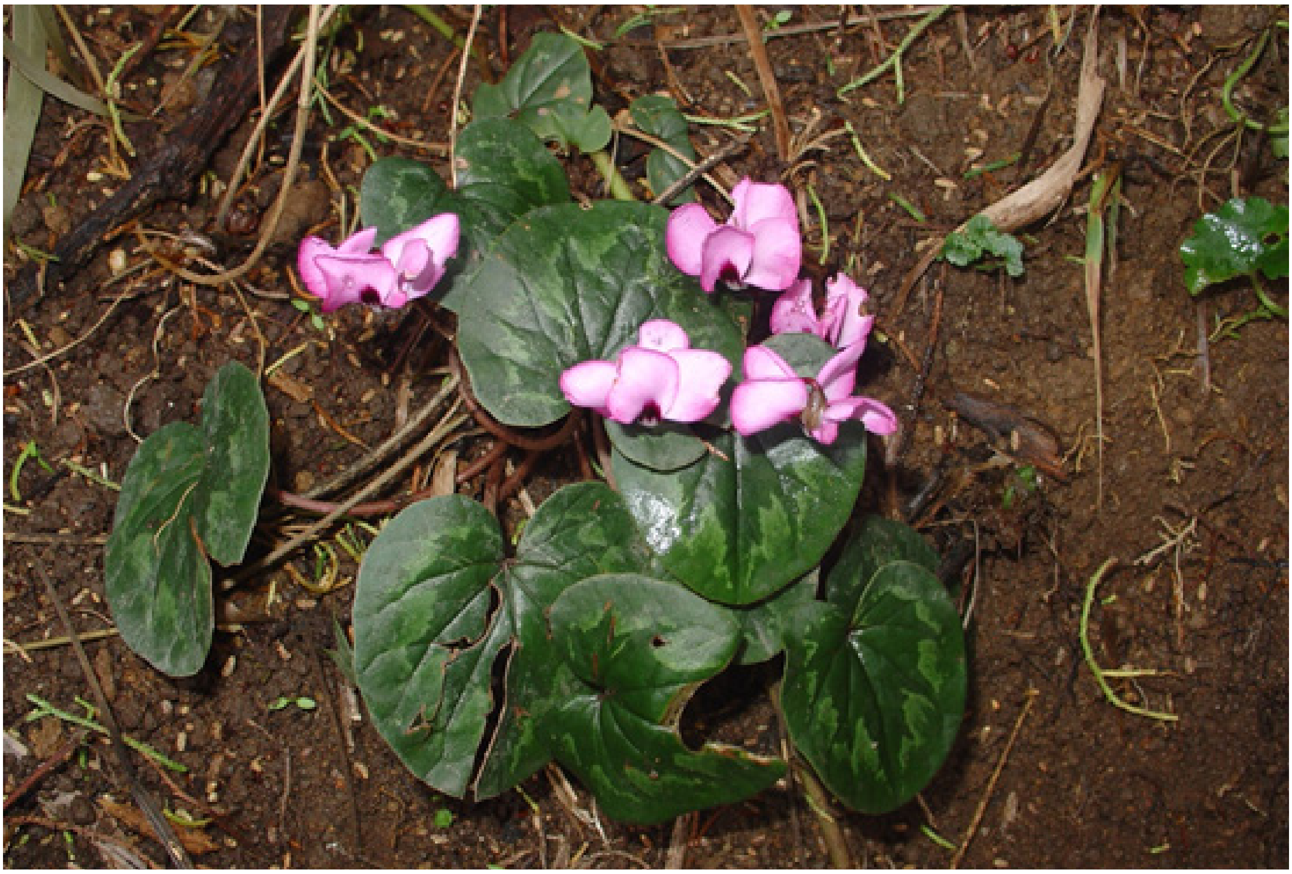

Figure 33. The Ajara-Lazeti endemic *Cyclamen adzharicum* at Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

The flora of the nominated component areas contains 44 **threatened or near-threatened species**, of which 39 are endemic to the Caucasus (Solomon et al. 2014), the latter including 35 species endemic to Colchis (Memiadze et al. 2013). Of the threatened / near-threatened species, 10 are from the IUCN Red List of Threatened Species (eight of them Caucasus endemics). 16 species are listed on the Red List of Georgia. There is some overlap of species between the Red Lists, with differences in categories as a result of global vs. national levels of assessment (Table 5).

The highest number of threatened species including the majority of the species occurring inside a single nominated component area are present in Mtirala-Kintrishi nominated component area: 35 (incl. 26 endemics of Colchis), and 19 (incl. 8 endemics of Colchis) of 26 in total, respectively. Of the species not recorded there, *Solidago turfosa* and *Rhynchospora caucasica* are present at the nominated component areas in the Colchic Lowlands (excl. Ispani).

The 7 species each with a single locality on the study area and not recorded on Mtirala-Kintrishi component area are present in the following other areas: *Hibiscus ponticus, Trapa colchica, Trapa maleevii* as typical wetlands species and *Zelkova carpinifolia* are only present in the nominated component areas of the Colchic Lowlands. *Rhododendron smirnovii* and *Campanula makaschwili* are other important threatened Colchic species, but do not occur inside the nominated component areas.

Four of the 37 species from the Red List of the Caucasus endemic species (Solomon et al., 2014) are assessed as CR. Two of these assessments are published on the IUCN Red List of Threatened Species. Of these, *Psephellus adjaricus* and *Ranunculus vermirrhizus* are only present in the north-eastern part of the Mtirala-Kintrishi nominated component area (in Kintrishi SNR), and *Hibiscus ponticus* and *Trapa colchica*, as mentioned above, only in the nominated component areas inside Kolkheti National Park.

The above figures are likely to be a minimum estimate: While relatively reliable data are available for the species endemic to Georgia or the Caucasus, thanks to the recent IUCN Caucasus Endemic Plant Red List Assessment (Solomon et al. 2014), many plant species with a wider geographical distribution have not been assessed for inclusion in the IUCN Red List.

Intraspecific genetic diversity in plants: Some plant species of the Colchic Lowlands also show conspicuous intraspecific genetic diversity, which would be consistent with ongoing evolution and speciation processes. For example, genetic diversity in the peat moss *Sphagnum austinii* is generally low throughout Europe, but high in western Georgia including the nominated component areas within Kolkheti National Park (Kyrkjeeide et al. 2016).

Fauna

The Colchic Rainforests and Wetlands are not only a global centre of plant diversity, but equally important for fauna, including many endemic and globally threatened species.

Species richness in vertebrates: 474 vertebrate species have been recorded within the nominated component areas of the proposed property (Table 6, Appendix 3). By far most of them are birds (327), followed by mammals (67), fish (55), reptiles (15) and amphibians (10).

Table 6. Species richness of main vertebrate groups in the nominated component areas of the Colchic Rainforests and Wetlands. Note that the five component areas within Kolkheti National Park (Grigoleti, Imnati, Pitshora, Nabada, Churia) are treated as one in this analysis. (Source and further details: Appendix 3)

	Fish	**Amphibians**	**Reptiles**	**Birds**	**Mammals**[1]	**All**
Mtirala-Kintrishi	2	8	14	189	62	275
Ispani	9	6	8	?[2]	38	61[3]
Kolkheti National Park	53	6	8	296	49	412
All	**55**	**10**	**15**	**327**	**67**	**474**

[1] including bats

[2] No data on avifauna of Ispani nominated component area available. The avifauna of this area is a subset of that of the nominated component areas within Kolkheti National Park

[3] excluding birds

Avifauna: Only 123 of the 327 bird species recorded within the series breed there; the majority visits during migration and/ or winter only. The nominated component areas within the Colchic Lowlands (e.g. all nominated component areas except Mtirala-Kintrishi) with their buffer zones harbored 368,000 birds of 40 species during winter counts in 2014 (Javakhishvili et al. 2014). They are a regionally important water bird migration and wintering site (e.g. Figure 34). It is also noteworthy for its very high winter abundances of a number of common pan-European species such as the Crested Grebe *Podiceps cristatus*.

The **Batumi bottleneck of raptor migration**, which strongly overlaps with Mtirala-Kintrishi nominated component area, is the single most important convergence zone for raptors in the western Palearctic – and probably the whole of Eurasia – during autumn migration (Harris 2013, Verhelst et al. 2011). The bottleneck is located where the mountains of the Lesser Caucasus descend to the Black Sea coast. Overall counts regularly exceed one million passing raptors of 35 species per season (Batumi Raptor Count 2016, 2017). This includes 50% of the global populations of three species of raptors (European Honey-buzzard *Pernis apivorus*, Levant Sparrowhawk *Accipiter brevipes*, and Booted Eagle *Hieraaetus pennatus*), over 10% of the global populations of another three species (Black Kite *Milvus migrans*, Lesser Spotted Eagle *Aquila pomarina*, and Pallid Harrier *Circus macrourus*) and more than 1% of the global population of another four species of raptors. The biggest part of the Batumi bottleneck overlaps with Mtirala-Kintrishi nominated component area (Figure 35), although many birds also cross areas outside. Roosting happens inside and outside the component area, but is poorly understood.

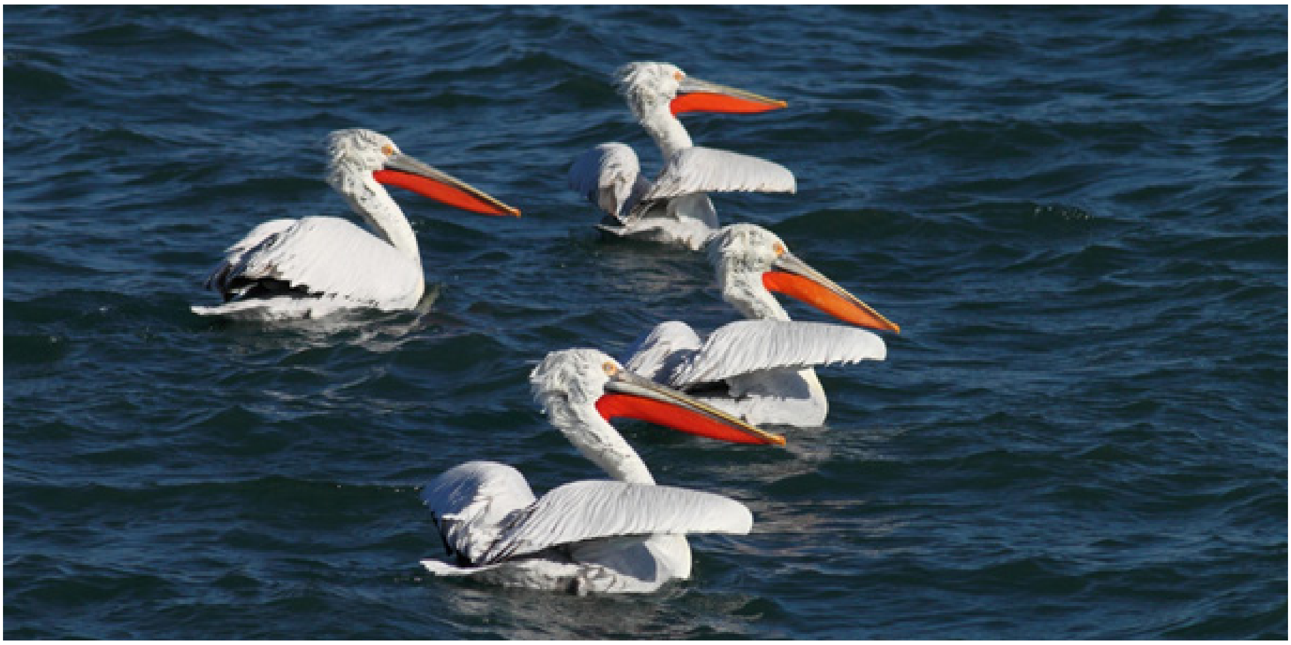

Figure 34. Resting Dalmatian pelicans *(Pelecanus crispus),* a globally near-threatened species, in the buffer zone of Imnati and Pitshora nominated component areas. (Photo: Levan Ninua)

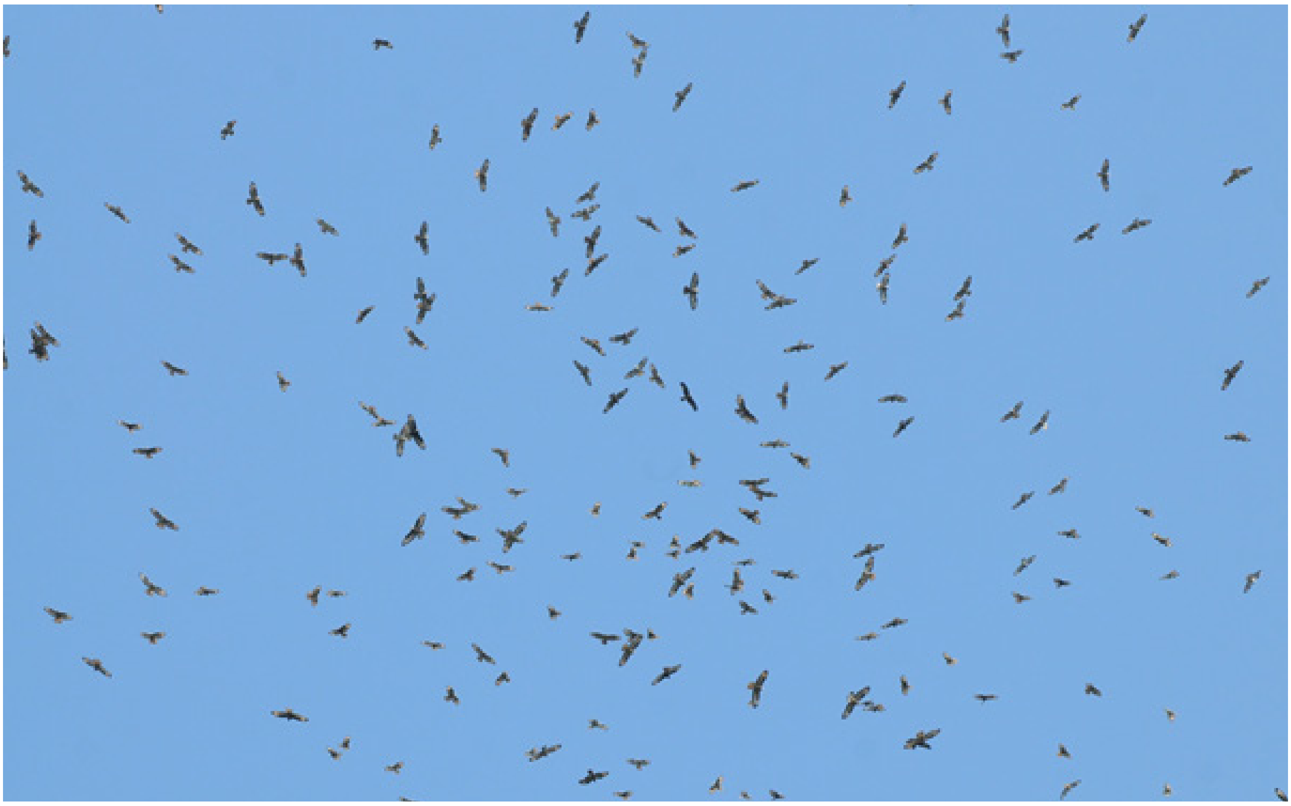

Figure 35. Honey buzzards *(Pernis apivorus)* congregate during autumn migration at the Batumi raptor migration hotspot, at Mtirala-Kintrishi nominated component area. (Photo: Christian Gelpke)

The extensive old continuous forest areas of Mtirala-Kintrishi nominated component area are highly important for forest bat species such as *Barbastella barbastellus*, *Myotis nattereri*, *Myotis mystacinus*, *Myotis brandtii*, *Myotis aurascens*, *Myotis alcathoe*, *Nyctalus noctula*, *Nyctalus leisleri*, the globally vulnerable *Nyctalus lasiopterus*, *Pipistrellus nathusii*, *Plecotus auritus*, and *Plecotus macrobullaris* (I. Natradze, pers. comm.).

Invertebrates: The overall species richness of the invertebrate fauna of the Colchic Rainforests and Wetlands cannot be estimated currently, due to a lack of sufficient data. However, some well-studied groups show both high species richness – particularly if calculated in relation to the study area – and high endemism. For instance, the diversity of land mollusks of Georgia is moderately well investigated comprising at least 265 terrestrial species (Mumladze, 2013, Mumladze et al. 2014, Walther et al. 2014). This unusually high species density (projected per 1,000 km^2) makes the country one of the speciose in Europe. Southwestern Georgian mountain forests (part of which are covered by protected areas of Kintrishi, Mtirala and Machakhela) as well as the Colchic lowlands and Borjomi-Kharagauli National Park are the most species rich areas within Georgia. A high species diversity is also notable for other invertebrate groups such as butterflies, dragonflies, mayflies etc., although accurate distributional data for these charismatic groups of species are limited. Articles reporting the species distribution of some targeted areas appeared only recently for dragonflies (Schröter et al. 2015) and mayflies (Martynov et al. 2015, Kluge et al. 2013, Godunko et al. 2015). After recording 34 species (with a number of pontic endemics), Kintrishi PAs were suggested as a regional hotspot of mayfly diversity (Martynov et al. 2016).

Any survey of invertebrates results in new species either for science or for the area, indicating only a very basic understanding of invertebrate biodiversity of the targeted territories. As example, a recent survey of small streams in Mtirala-Kintrishi nominated component area resulted in a discovery of *Helicopsyche* sp. (not yet published) which is a first record of this genus from the Caucasus ecoregion. This genus is most abundant in the tropics and Australia, while only a 4-5 species are known from southern Europe. The closest previously known locality is 800 km to the South-west, in Turkey (Johanson, 1995).

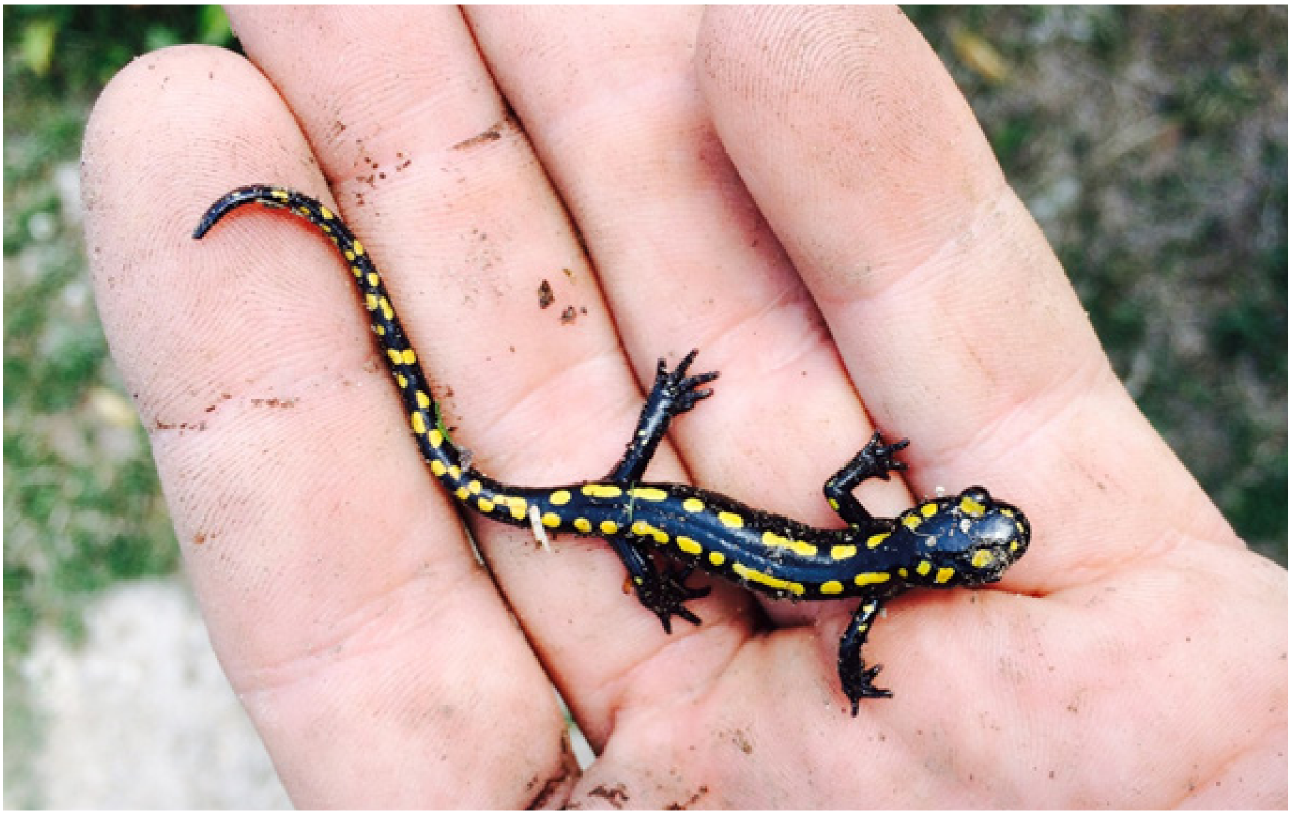

Figure 36. The globally vulnerable Caucasian salamander *(Mertensiella caucasica),* which is endemic to the Caucasus and represented by a cryptic species of even more restricted range within the Mtirala-Kintrishi nominated component area. (Photo: Giorgi Rajebashvili)

Endemic terrestrial vertebrates (Table 7): Besides the Caucasus endemics Caucasian Toad *Bufo verucosissimus*, Caucasian Parsley Frog *Pelodytes caucasicus*, and Caucasian Salamander *Mertensiella caucasica* (Figure 36), an endemic subspecies of the Northern Banded Newt *Ommatotriton ophryticus* lives in the Colchic forests including Mtirala-Kintrishi nominated component area (Bannikov et al. 1977, Tarkhnishvili & Gokhelashvili 1999). The latter has also been reported from the periphery of Ispani nominated component area. The populations of the Caucasian Salamander in Mtirala-Kintrishi nominated component area and in Borjomi-Kharagauli National Park further east are likely to represent separate cryptic species (Tarkhnishvili et al. 2008).

Table 7. Richness of restricted range species (Caucasus1 or narrower) within the main vertebrate groups in the nominated component areas of the Colchic Rainforests and Wetlands. Note that the component areas within Kolkheti National Park (Grigoleti, Imnati, Pitshora, Nabada, Churia) are treated as one in this analysis. (Source and further details: Appendix 3)

	Fish	**Amphibians**	**Reptiles**	**Birds**	**Mammals**	**All**
Mtirala-Kintrishi	1	3	7	1 (2?)	8	20
Kobuleti	2	0	2	0	4	8
Kolkheti	13	0	2	0	4	19
All	**14**	**3**	**7**	**1 (2?)**	**8**	**33**

[1] Black Sea for fish

Some amphibians (e.g. brown frogs – Tarkhnishvili et al. 2001) provide interesting examples of landscape-dependent speciation in the Colchic Rainforests and Wetlands, when specific conditions, e.g. sharp climatic/landscape gradients in mountains, triggers divergence without full isolation such as described in Endler (1986).

The reptile genus of the Colchic region with the highest proportion of Caucasus endemics is the rock lizard genus *Darevskia*. Three (potentially even four) ecoregional endemics are found within Mtirala-Kintrishi nominated component area. In addition, the Colchis Slow Worm *Anguis fragilis*, Caucasian Viper *Vipera kaznakovi* (Figure 37) and Transcaucasian Rat Snake *Zamenis hohenackeri* have been reported from there. The endemic herpetofauna of Mtirala-Kintrishi nominated component area and its surroundings also provide compelling examples of ongoing evolution and speciation within this refuge area (Box 3, Figure 38).

The PAs of the Colchic Rainforests and Wetlands contribute to the Caucasus Endemic Bird Area (BirdLife International 2017), with breeding populations of the Caucasian Black Grouse *Lyrurus mlokosiewiczi* (Figure 39), as well as potentially of the Caspian Snowcock *Tetraogallus caspius* in the upper Kintrishi Valley within Mtirala-Kintrishi nominated component area. The status of the Caucasian Chiffchaff Phylloscopus (simianus) lorenzii, which also occurs there, is contested.

The series has ten species and one subspecies of mammals endemic to the Caucasus ecoregion, most of them rodents and shrews. Among them, the enigmatic Long-clawed Mole Vole *Prometheomys schaposchnikowi* is globally near-threatened (IUCN 2017). Landscape dependent speciation has been observed in the snow voles (Buzan & Kryštufek 2008).

Endemic Ichthyofauna: Distribution ranges of fish typically coincide with large-scale drainage basins not terrestrial ecoregions. This is also true for the ichthyofauna of the Colchic forests and particularly wetlands, which comprise a wide range of species (14) that are endemic either to the southeastern part of the Black Sea Basin, or the entire basin, or the Ponto-Caspian region (details: Appendix 3). The only fish species endemic to the Caucasus is the Caucasian Goby *Ponticola constructor*, of Imnati and Pitshora nominated component areas.

The spawning areas of the Black Sea Salmon *Salmo labrax*, which – as its name suggests – is endemic to the Black Sea, are concentrated in mountain rivers of western Georgia. Among them, the Kintrishi River within Mtirala-Kintrishi nominated component area is a particularly important spawning ground of this species (Guchmanidze 2014b, 2016a).

Endemic invertebrates: Although invertebrates are generally poorly studied in the Caucasus eco-region, it seems that the western Georgian (Colchic) invertebrate species pool is highly diverse with high level of endemism. One iconic example is the Colchic crayfish Astacus colchicus (Figure 40). The mountain forests of Mtirala-Kintrishi nominated component area as well as those of the lowland component areas boast disproportionally high numbers of local endemic species in pan-European comparison (Mumladze, et al., 2014). Endemism is particularly widespread among the mollusks (Figure 41).

Box 3. Ongoing speciation and evolution within the Colchic Rainforests and Wetlands.

The high ecological or hidden genetic diversity of some taxonomic groups suggests that the Colchic Rainforests and Wetlands are an important area for on-going evolutionary and speciation processes.

The examples of actively evolving highly speciose groups of organisms include rock lizards (*Darevskia*, syn. *Caucasilacerta*) and vipers (subgenus *Pelias*). Caucasian mountain vipers, until recent time, were considered to represent two or three species, a wide-spread *Vipera ursini* and Colchis endemic *Vipera kaznakovi* (Figure 37).; some scientists separated a third species, *Vipera dinnicki*. Recent genetic and morphological studies triggered description of several new species (Tuniyev et al. 2009). Some of them are found only or almost exclusively in the Colchis region. These species are: *Vipera kaznakovi* – existing throughout the mountain forest belt of Colchis; *V. dinnicki* – from the uplands of the Greater Caucasus (including high mountains within the basin of the Black Sea, e.g. upper Svaneti region); *V. orlovi* and *V. lotievi* – north-western and the northern Caucasus; *V. darevskyi* – southern Georgia and Armenia; *V. erivanensis* – from Armenia and some parts of SW Georgia including Shavsheti Range in the Black sea Basin (Guram Iremashvili, pers. com.); *V. barani* – from parts of Turkey close to southwestern Georgia. Although genetic differences between these species are minor, there is a taxonomist consensus on their distinct species status.

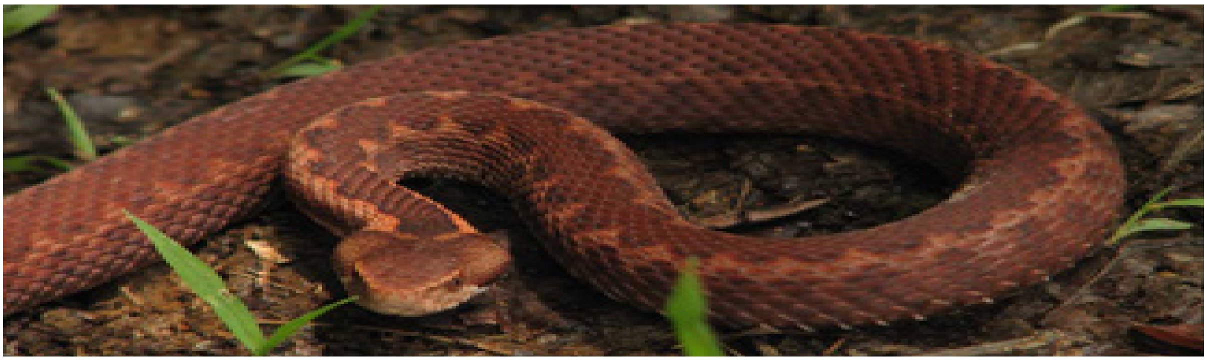

Figure 37. The globally endangered *Vipera kaznakovi*. Photo: David Tarkhnishvili.

The situation with *Darevskia* (Caucasilacerta) is probably even more interesting. There are 26-28 described sexually breeding species of this monophyletic group, most of which are endemic to the Caucasus Ecoregion, such as *Darevskia mixta*. Hence, they probably are the most speciose vertebrate group per unit area within the non-tropical northern hemisphere. The group also has seven distinct parthenogenetic (asexually reproducing) “species” (Tarkhnishvili 2012). Most of the species are distinct and sometimes up to 4-5 species coexist in a single habitat. Occasionally, hybridization occurs, but this does not cause assimilation or loss of morpho-ecological distinctness. Reticulate speciation has clear evidence in some cases (Darevsky 1967, Tarkhnishvili et al. 2013). The Colchis including particularly Mtirala-Kintrishi nominated component area is particularly rich in rock lizard (*Darevskia*) species, with some having extremely narrow distributions (such as *Darevskia dryada* Figure 38b). Altogether, there are over 25 species of this group found from Turkmenistan to the Balkans, and the Colchis has at least ten of them, probably being the centre of diversification of the group (Tarkhnishvili 2012). Six of that are found exclusively in the wider Colchis area. Up to five species are found sympatrically in some locations described below.

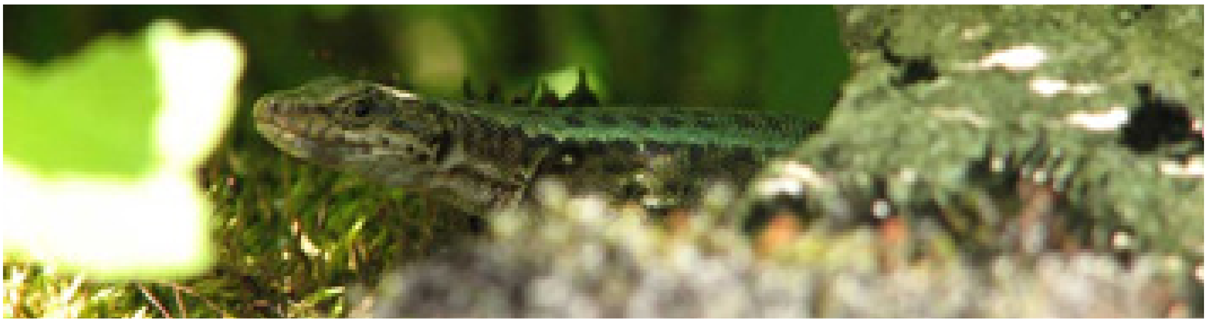

Figure 38. The globally critically endangered *Darevskia dryada.* Photo: David Tarkhnishvili.

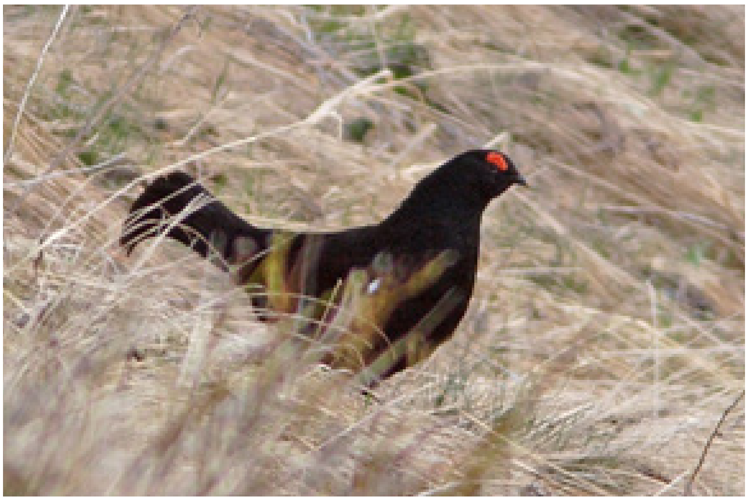

Figure 39. Caucasian black grouse *(Tetrao mlokosiewiczi),* a globally near-threatened Caucasus endemic and one of the trigger species of the Caucasus Endemic Bird Area, which breeds within Mtirala-Kintrishi nominated component area. (Photo: Giorgi Darchiashvili)

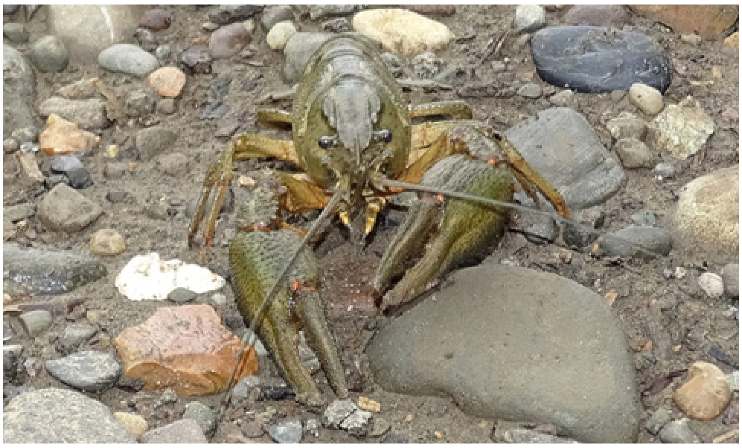

Figure 40. The Colchic crayfish *Astacus colchicus,* a Colchic endemite among the invertebrates. (Photo: Levan Mumladze)

Globally threatened vertebrates: The number of globally threatened vertebrate species of the Colchic Rainforests and Wetlands is considerably lower than that of vascular plants (Table 8, Appendix 3). However, the wider area including the series is home to important populations of globally threatened fish as well as herpetofauna, and supports considerable numbers of Red-listed breeding and migratory bird species.

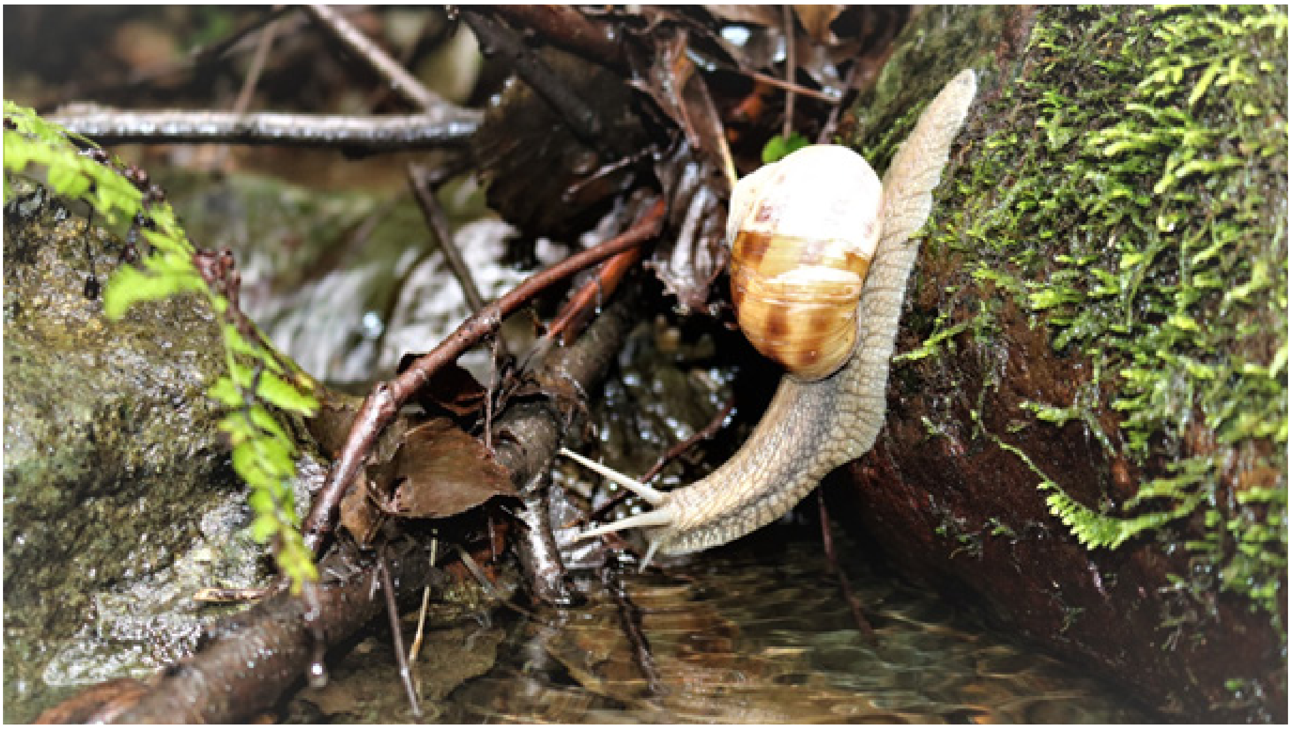

Figure 41. The gastropod *Helix buchii,* a Colchic endemic and relict species. (Photo: Levan Mumladze)

Table 8. Number of globally near-threatened and threatened species within the main vertebrate groups in the nominated component areas of the Colchic Rainforests and Wetlands. Note that the component areas within Kolkheti National Park (Grigoleti, Imnati, Pitshora, Nabada, Churia) are treated as one in this analysis. (Source and further details: Appendix 3)

	Fish	**Amphibians**	**Reptiles**	**Birds**	**Mammals**[1]	**All**
Mtirala-Kintrishi	0	4	4	16	3	26
Ispani	1	0	3	?[2]	2	5[3]
Kolkheti National Park	5	0	3	30	2	39
All	**5**	**4**	**5**	**33**	**3**	**50**

[1] including bats

[2] No data on avifauna of Ispani nominated component area available. The avifauna of this area is a subset of that of the nominated component areas within Kolkheti National Park

[3] excluding birds

The Colchic region is one of the very last areas in the world where Ponto-Caspian sturgeons are still regularly spawning. The Rioni, which borders the potential property, is one of four still active spawning rivers for Ponto-Caspian sturgeons in the world (together with the Danube, the Volga and the Ural). It is the last active sturgeon river in Georgia: four species of sturgeons that are critically endangered globally spawn in the Rioni, and two additional species might still occur - Beluga *Huso huso*, Russian Sturgeon *Acipenser gueldenstaedtii*, Stellate Sturgeon *Acipenser stellatus*, Ship Sturgeon *Acipenser nudiventris*, Atlantic Sturgeon *Acipenser sturio* and Colchic Sturgeon *Acipenser colchicus*. After its extirpation in Russia and Turkey - the Colchic Sturgeon is now endemic to the rivers of Kolkheti.

However, only small numbers of sturgeon juveniles (Colchic Sturgeon and Stellate Sturgeon) visit Paliastomi Lake within Kolkheti National Park for feeding purposes - but not for breeding - nowadays (Guchmanidze 2009, 2012, 2014a, 2016c, Ninua & Guchmanidze, 2012). An extension of Kolkheti National Park to include the lower reaches of the Rioni River is in preparation, with support of WWF Caucasus. This would increase the relevance of the park – and potentially of an extended nominated property – for sturgeon conservation. In addition, the critically endangered European Eel *Anguilla anguilla* and the vulnerable Common Carp *Cyprinus carpio* occur in the Paliastomi lake, which belongs to the buffer zone of the property.

Noteworthy populations of globally threatened herpetofauna of the Colchic Rainforests and Wetlands include those of the globally vulnerable Caucasian Salamander *Mertensiella caucasica*, as well as Clarke's Lizard *Darevskia clarkorum* and the Caucasian viper *Vipera kaznakovi*, which are both globally endangered (IUCN 2018).

Most of the 33 globally threatened bird species of the series have been recorded during migration. The only potential breeding bird falling into this category is the globally endangered White-headed Duck *Oxyura leucocephala*, at the nominated component areas within Kolkheti National Park. This species also occurs at the Kolkheti wetlands during migration, along with other migratory waterbirds including the Dalmatian Pelican *Pelecanus crispus*, Lesser White-fronted Goose *Anser erythropus*, and Common Pochard *Aythia ferina*, which are all globally vulnerable (Javakhishvili et al. 2014).

Apart from the Kolkheti wetlands, the second area of outstanding importance for globally threatened birds within the Colchic Rainforests and Wetlands is the Batumi bottleneck of raptor migration, which overlaps with the southwestern end of Mtirala-Kintrishi nominated component area. Several globally endangered (e.g. the Steppe Eagle *Aquila nipalensis*, Egyptian Vulture *Neophron percnopterus*, and Saker Falcon *Falco cherrug*) as well as vulnerable raptor species (e.g. Eastern Imperial Eagle *Aquila heliaca* and Greater Spotted Eagle *Clanga clanga*) are observed regularly – and sometimes in considerable numbers – during autumn migration (Batumi Raptor Count 2016, 2017). The Batumi bottleneck is discussed in more detail below.

While the Colchic Forest and Wetlands support significant populations of some large mammals which have become relatively rare in other parts of pan-Europe (e.g. Brown Bear *Ursus arctos* and European Lynx *Lynx*

lynx), no globally threatened mammals have been found there – only the near-threatened European Otter *Lutra lutra* and Long-clawed Mole-vole *Prometheomys schaposchnikovi*.

Globally threatened invertebrates: A number of invertebrate species occurring in western Georgia are threatened and included in the IUCN Red List. However, all of these species are known from pan-Europe, and Georgian populations were not considered (or only to a very limited extent) during the assessment of their conservations status. At the same time, Georgian populations of each these species are of particular importance as they represent either marginal or well-preserved and abundant populations. More than 90% of globally threatened species occurring in Georgia are represented in western Georgia including the series. The conservation status of the great majority of local or regional endemic invertebrates has not been assessed. Nevertheless, all the invertebrate species included in international or national red lists are mostly occurring in western Georgia and specifically one or more nominated component areas. These include the globally vulnerable Noble Crayfish *Astacus astacus* and Apollo butterfly *Parnassius apollo*, as well as the globally endangered freshwater snail *Belgrandiella adsharica*.

2.a.2 Overview of distribution of values among nominated component areas

Before the nominated component areas of the series are described in detail, this section provides a concise overview over the distribution of the main ecosystems, habitats and vegetation as well as flora and fauna between the nominated component areas of the Colchic Rainforests and Wetlands.

Ecosystems, habitats and vegetation

Most of the forest ecosystems of the Colchic Rainforests and Wetlands as well as the subalpine ecosystems that accompany them at their highest altitude are concentrated in Mtirala-Kintrishi nominated component area.

However, there are also important – if smaller – areas of Colchic forests in two of the nominated component areas in the Colchic Lowlands (Figure 23), namely inside Kolkheti National Park at the nominated component areas of Pitshora and Churia. The latter all belong to Type A – Colchic lowland forests.

The main ecosystems in the six nominated component areas inside the Colchic Lowlands (Ispani within Kobuleti Strict Nature Reserve, as well as Grigoleti, Imnati, Pitshora, Nabada and Churia within Kolkheti National Park) are different types of peatlands, which are accompanied by other wetland habitats to varying degrees.

Table 3 provides an overview of the distribution of ecosystems, habitats and vegetation across the nominated component areas of the Colchic Rainforests and Wetlands.

Flora

Reflecting the distribution of ecosystems and habitats, the flora of the Colchic Rainforests and Wetlands is also distributed unevenly (Table 4, 5, Appendix 2). There is a remarkable difference between Mtirala-Kintrishi nominated component area with its Colchic rainforest on the one hand, and the peatland and associated ecosystems of the Colchic Lowlands on the other hand: The species diversity of vascular plants as well as the number of endemics is much greater in the former than in the latter. In all distinguished groups of endemics, the Mtirala-Kintrishi nominated component area has the highest number of endemic plants.

While relatively species-poor at the individual site level, the diverse peatland and other wetland ecosystems of the Colchic lowlands form a considerable ß-diversity and thereby also contribute to overall γ- biodiversity throughout the Colchic Rainforests and Wetlands (Joosten et al. 2003). The six nominated component areas within the Colchic Lowlands alone represent various stages of peatland succession, partly towards pure ombrotrophic percolation bogs. These stages also create different habitats for flora (and fauna), together with the riparian forest and freshwater ecosystems that are directly associated with them. Ecological flows and the life cycles of the fauna and flora of the area link these diverse ecosystems intimately to each other.

Thus, Mtirala-Kintrishi nominated component area is the richest not only in forest vegetation types, but also has the highest general species richness as well as endemic and threatened species richness. However, all the nominated component areas together ensure conservation of the major forest and wetland ecosystems of the Colchis with their plant diversity.

Fauna

The same pattern as for flora is observed for fauna (Table 6, 7, 8, Appendix 3), with some notable exceptions: Mtirala-Kintrishi nominated component area is home to most breeding bird species, while the nominated component areas in the Colchic Lowlands are visited by many more migratory species (particularly migratory waterbirds).

The contribution of the component areas to the species richness of other groups of the Colchic Rainforests and Wetlands also differs strongly: The freshwater bodies of Kolkheti National Park (i.e. Grigoleti, Imnati, Pitshora, Nabada and Churia nominated component areas with their buffer zones) support the great majority of ichthyofauna, whereas the forest PAs are more important for herpetofauna and mammals. The terrestrial vertebrate faunas of the forest and wetland areas are generally rather different, and complement each other. While the invertebrates of the Colchic Lowlands are relatively poorly studied, it is likely that a similar relationship exists there.

2.a.3 Description of nominated component area No. 1.: Mtirala-Kintrishi

Size, location and topography

The nominated component area (20,150 ha) of Mtirala-Kintrishi is located in Adjara Autonomous Republic, to the east of the Black Sea coast between the city of Batumi and the town of Kobuleti (Figure 2). It lies fully within Mtirala National Park, Kintrishi Strict Nature Reserve and Kintrishi Protected Landscape[1], which form a continuous series of PAs. Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

Mtirala-Kintrishi nominated component area is part of the western Adjara-Imeretian (Meskheti) mountain range within the western Lesser Caucasus, i.e. the central Colchic area, ranging from 250 m to 2,596 m a. s. l. The area has a complex orography with frequent changes in valley orientation, and shifting slope exposure as well as inclination (Figure 42).

Geology and soils

The geological structure of Mtirala-Kintrishi is formed by Paleocene, Eocene, Oligocene, Pliocene and post-Pliocene sedimentary and volcanic rocks of the Cretaceous and Tertiary periods. Basalts, andesites, various tuffs, and tuff-breccias dominate (APA, 2015; GeoGraphic, 2016).

The soil types of Mtirala-Kintrishi nominated component area form an altitudinal series of red soils (250-300 m a.s.l.), yellow soils (250-600 m a.s.l.), yellow-brown forest soils (400-1,000 m a.s.l.), brown forest soils (800-2,000 m a.s.l.) and mountain meadow soils (above 1,800 m a.s.l.) as described in Section 2.a.1 above (cf. Urushadze & Blum 2014).

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1 Kintrishi Strict Nature Reserve and Kintrishi Protected Landscape are currently undergoing a re-designation and re-zoning process, which will be finalized in mid-2019. A new Kintrishi National Park will integrate the Protected Landscape and parts of the Strict Nature Reserve. This may lead to a minor re-configuration of the protected areas constituting the Mtirala-Kintrishi nominated component area by mid-2019, but in any case not to a net loss of adequate protection of its Outstanding Universal Value.

Figure 42. Mountain landscape in Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

Climate

The climate of Mtirala-Kintrishi nominated component area is warm-temperate and humid. It is the most humid of the entire series and among the most humid areas in the temperate climate zone. Annual precipitation exceeds 4,500 mm at Mount Mtirala within Mtirala National Park, and 2,700 mm in Kintrishi Gorge (Figures 43, 44). Precipitation tends to increase with altitude and also depends on local topography, with pronounced small-scale heterogeneity (GeoGraphic, 2016).

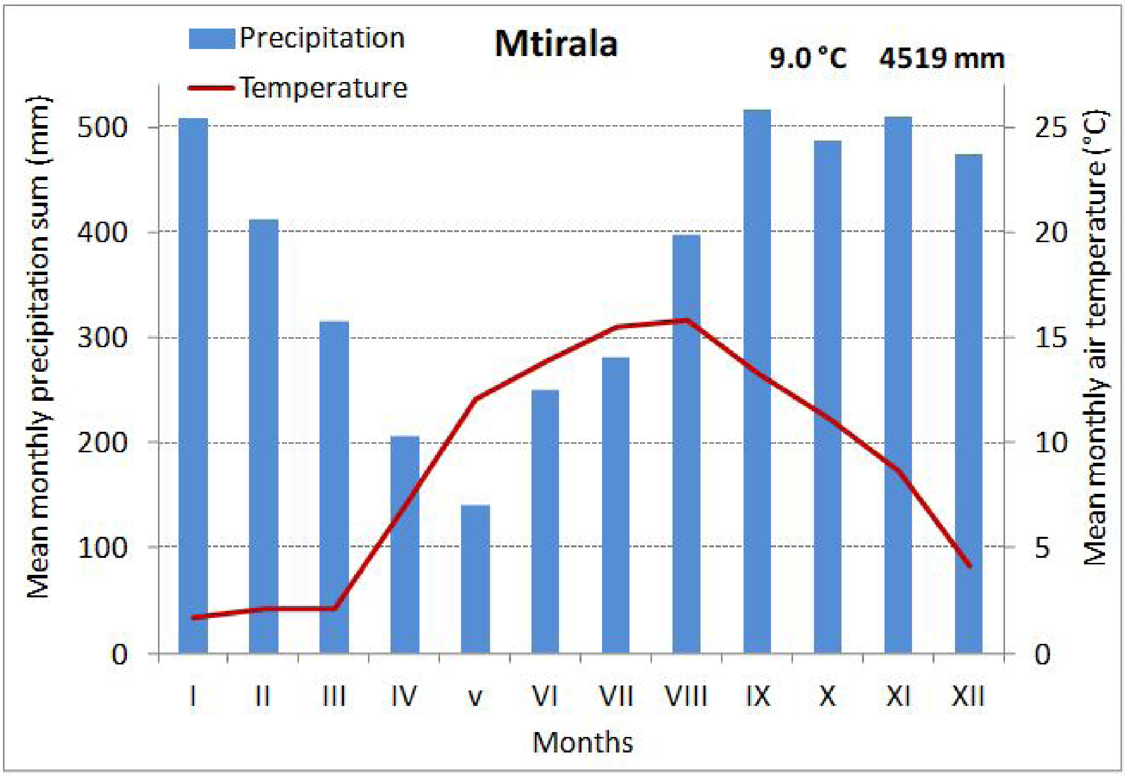

Figure 43. Climate diagram of Mount Mtirala, Mtirala-Kintrishi nominated component area. Source: Mtirala climate station data 1980 – 85.

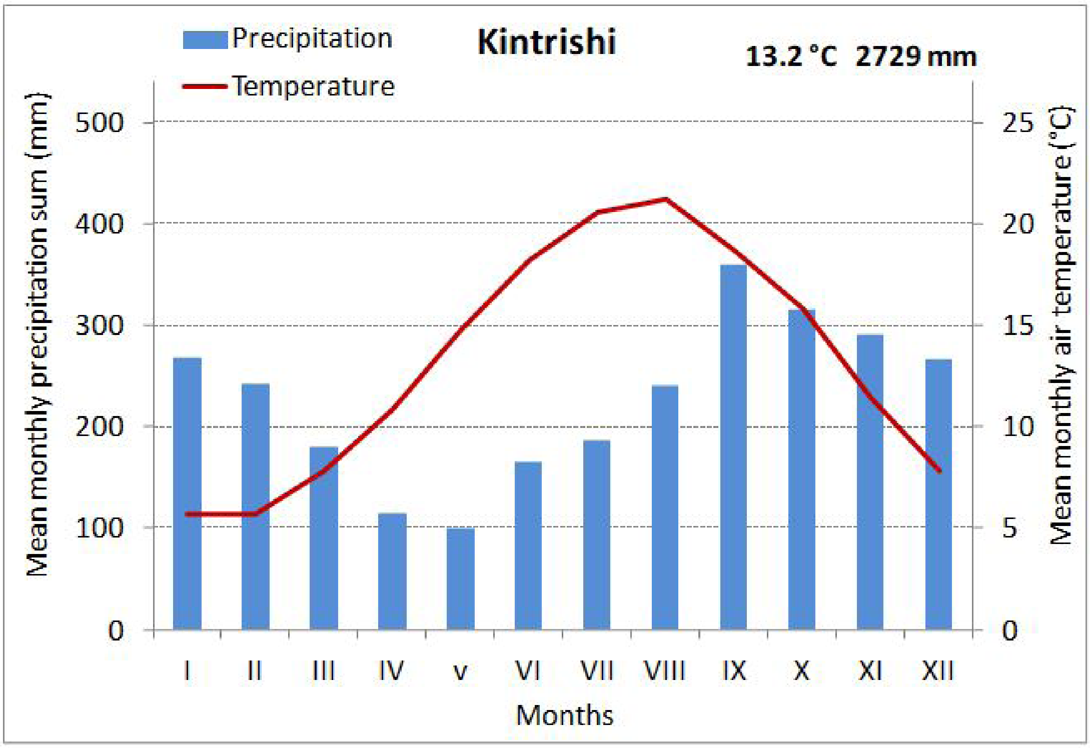

Figure 44. Climate diagram of Kintrishi Gorge, Mtirala-Kintrishi nominated component area. Source: Mandjavidze 1975.

Annual mean temperatures and seasonality within the nominated component area also depend on altitude. Below 500 m a.s.l., summers are long and warm (average August temperature 24 °C at Kintrishi valley) and the average January temperature is 4 °C. In contrast, summers are relatively short (vegetation period 3.5 – 4.5 months) and cool above 1,800 m a.s.l., with long winters as well as considerable and snow cover lasting well into spring (GeoGraphic, 2016).

Hydrology

The area includes the upper watersheds of the Chakvistskali and Kintrishi rivers, which both discharge into the Black Sea. In addition, most of the upper part of the Korolistskali watershed (also discharging into the Black Sea) is included within the south-western part of this component area. Rivers and small streams are mainly fed by springs and snow-melt waters from alpine and sub-alpine mountains. Some rivers form waterfalls (Figure 45). There is 30-m waterfall at the Misanati River and a two-step 70 m waterfall at the Chrdial River. There are two small alpine lakes (Tbikeli and Didvake, Figure 46) and various river ponds (Figure 47) located within the area.

Figure 45. Waterfall within Mtirala National Park, Mtirala-Kintrishi nominated component area. (Photo: Paata Vardanishvili)

Figure 46. Tbikeli Lake, Mtirala-Kintrishi nominated component area, 2,230 m. a.s.l. (Photo: Zurab Manvelidze)

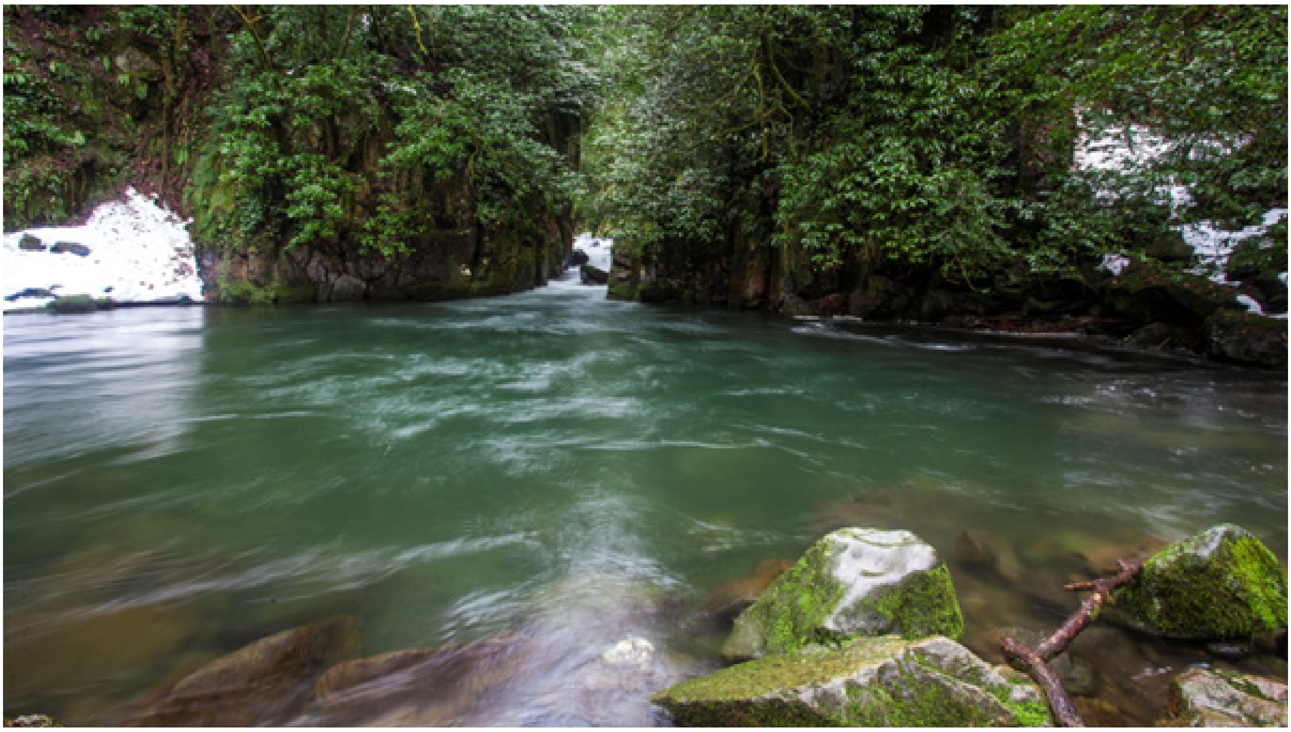

Figure 47. Stream pool at Mtirala National Park, Mtirala-Kintrishi nominated component area, in winter. Note evergreen vegetation. (Photo: Paata Vardanashvili)

Ecosystems, habitats and vegetation

All major Colchic rainforest ecosystems as discussed in Section 2.a.1 with the exception of Colchic lowland forest are present within the Mtirala-Kintrishi nominated component area. It contains highly representative stands of the respective forest types of these zones (Kikodze and Gokhelashvili 2007, Dolukhanov 2010). 23 forest plant associations within five formations have been documented from the component area, in spite of its relatively small size. The Fageta are the richest in associations (12 formations), followed by the Castaneta (5), Carpineta (2), Alneta (2) and Betuleta (2) (Appendix 4).

In most of these associations, there is a characteristically rich undergrowth often of evergreen species. This includes Caucasian bladdernut (*Staphylea colchica*), Colchic box tree (*Buxus colchica*), rhododendron (*Rhododendron ponticum*), azalea (*Rh. luteum*), cherry laurel (*Laurocerasus officinalis*), viburnum (*Viburnum orientalis*), wild blackberry (*Rubus caucasicus*), Caucasian wortleberry (*Vaccinium arctostaphyllos*) and others.

The evergreen, high-bushy formations of *Shkeriani* (shrubbery Phytocenoses; Figure 48) are a particularly interesting phenomenon of the area. Here we have many highly characteristic Colchic relict shrubs: *Rhododendron ponticum, Rh. ungernii, Rh. luteum, Ilex colchica, Laurocerasus officinalis, Ruscus colchicus* etc. This vegetation growths in the Korolistskali Gorge (along the Namtsvavistskali, its right tributary), in the south-eastern part of the component area. The rare Ajara-Lazeti endemic *Epigaea gaultherioides* can be found there (Figure 49). The special conservation value of *Shkeriani* is that here 30-35 species of trees, bushes, and lianas can be found on one hectare. This is extraordinary for the temperate zone. The shrubbery in these areas is not rich in herbaceous cover, because of the dense evergreen undergrowth. However, some species loving humidity and shadow still can be found here, such as *Dryopteris oreopteris, Athyrium filix-femina, Blechnum spicant, Oxalis villosa* etc.

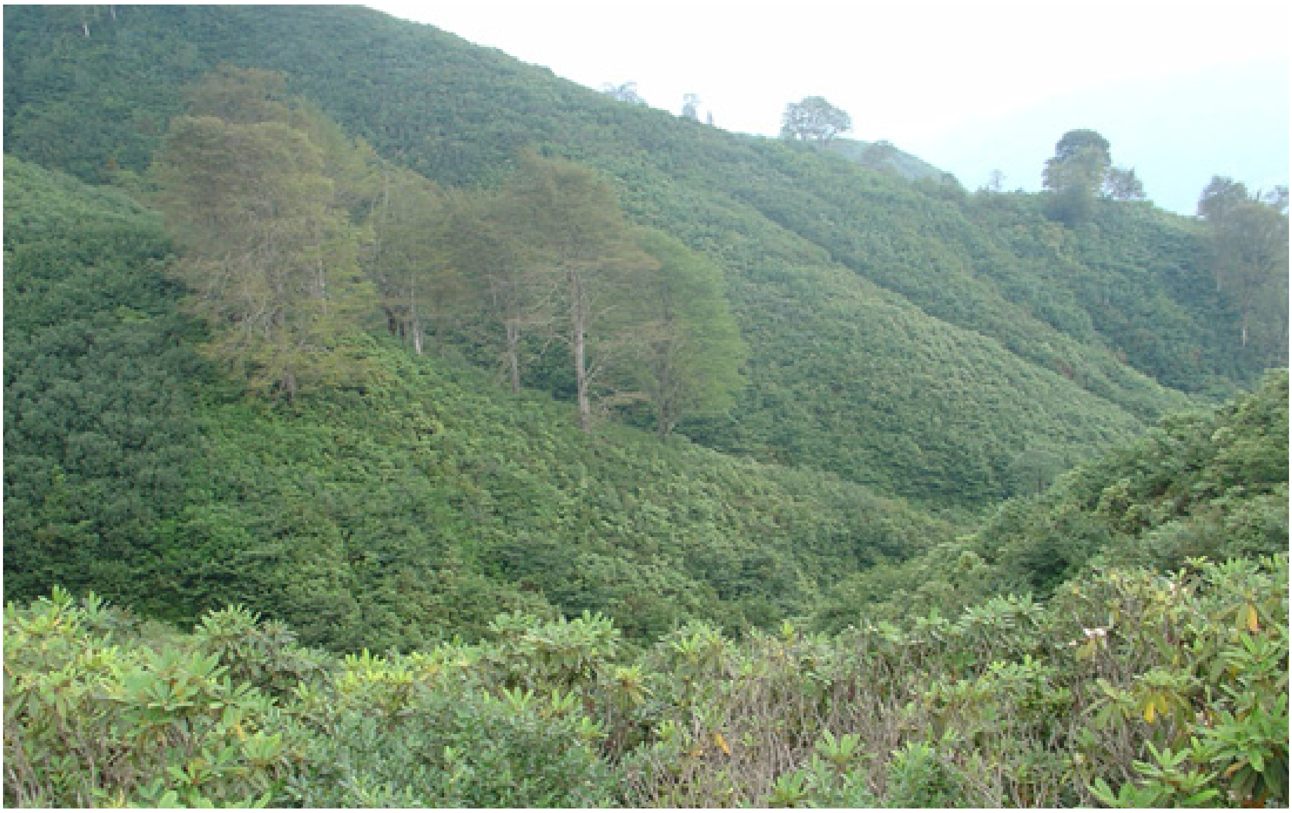

Figure 48. Fagetum mixtofructicosum (Shkeriani). (Photo: Zurab Manvelidze).

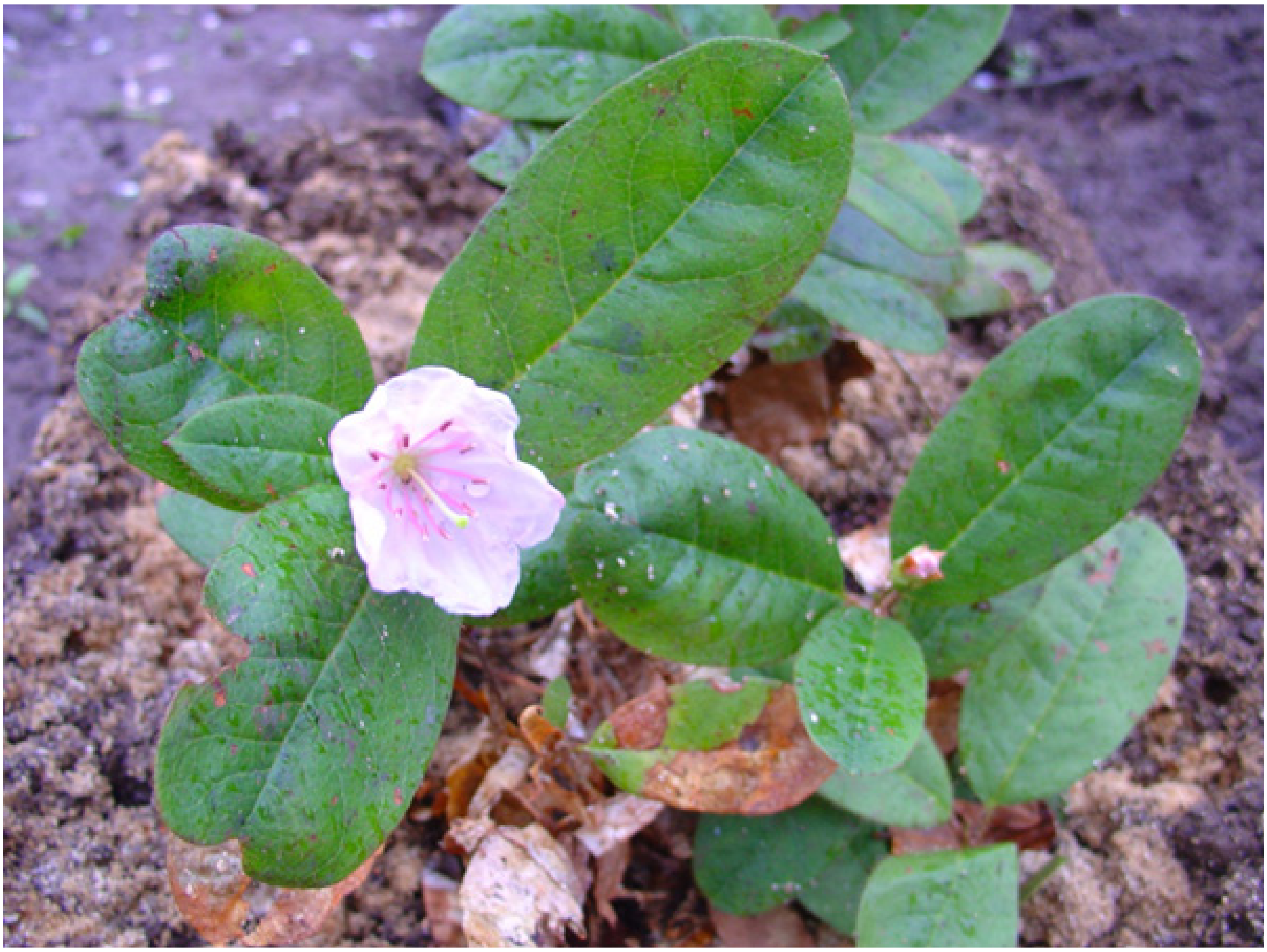

Figure 49. The rare Ajara-Lazeti endemic *Epigaea gaultherioides* at Mtirala-Kintrishi nominated component area. (Photo: Zurab Manvelidze)

There is marked spatial heterogeneity within the vegetation of this component area: Alneta are mainly found in the ravines, with dominant *Alnus barbata* in the lower zone and *A. incana* in the middle zone. Dark coniferous species (*Abies nordmanniana, Picea orientalis*) that make up dark coniferous and mixed beech-dark-coniferous forests with *Fagus orientalis* are best present in the north-eastern (Kintrishi) part of the area. Mixed beech-dark-coniferous forests also occur in its southwestern part. Nordmann's fir-Oriental spruce forest stands cover ca. 140 ha in Kintrishi Valley (Kikodze and Gokhelashvili, 2007). Sorbus species, components of ash-birch elfin woods in upper subalpine belt are also present at the highest altitudes of the Kintrishi part of this component area. *Quercus hartwissiana* and *Q. dschorochensis*, which are characteristic of the southern Colchic humid thermophilous Colchic broad-leaved forest zone up to 1,000-1,200 m a.s.l., occur in the southwestern part.

The highest altitudes of Mtirala-Kintrishi nominated component area (in upper Kintrishi Gorge) are characterized by Fageta and Betuleta formations, forest shrubberies, Subalpine high herbaceous, subalpine and alpine meadows and crushed stones floristic complexes of the Tertiary period, with participation of Colchic and Caucasian elements.

Flora

The flora of Mtirala-Kintrishi nominated component area is the species-richest of the series (906 species), and also the richest in relict, endemic (146 species) and globally threatened species (38 species) (Table 4, 5). It contains all the elements that are typical of the Colchic rainforests, as described in more detail in Section 2.a.1 (flora).

Fauna

Similar to the flora, Mtirala-Kintrishi nominated component harbours all the forest fauna of the Colchic Rainforests and Wetlands as discussed in Section 2.a.1 (fauna). It is the richest in diversity of herpetofauna, mammals and invertebrates, including relict, endemic and globally threatened species, and therefore the groups that demonstrate its proposed Outstanding Universal Value as a site of ongoing evolution and speciation (Table 6-8; see also Appendix 3).

All of the discussed species of fauna associated with the past of the Colchic Rainforests and Wetlands as a glaciation refuge, as well as ongoing evolution and speciation processes (see Section 2.a.1), occur in Mtirala-Kintrishi. These include the Caucasian salamander (*Mertensiella caucasica*), the Caucasian viper (*Vipera kaznakovi*), the lizards of the *Darevskia* genus, various small mammals as well as other vertebrate species and invertebrates.

Mtirala-Kintrishi is a refuge for large charismatic mammal species such as the Brown Bear (*Ursus arctos*) and Eurasian Lynx (*Lynx lynx*), an important stronghold of forest bats, and a hotspot of resident and breeding forest avifauna (Appendix 3). It holds populations of one (potentially two) bird species endemic to the Caucasus – the Caucasian Black Grouse (*Tetrao mlokosiewiczi*) and potentially the Caspian Snowcock (*Tetraogallus caspius*). The Batumi bottleneck of raptor migration strongly overlaps with the south-western part of this nominated component area.

2.a.4 Description of nominated component area No. 2: Ispani

Size, location and topography

The Ispani nominated component area (N 41°51.9' E 41°47.9', 248 ha, 1.5–6.5 m a.s.l.) consists mainly of the Ispani 2 Mire (Figure 50), which is located near the settlement of Kobuleti, 1-3 km distant from the Black Sea coast (Figure 3). Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

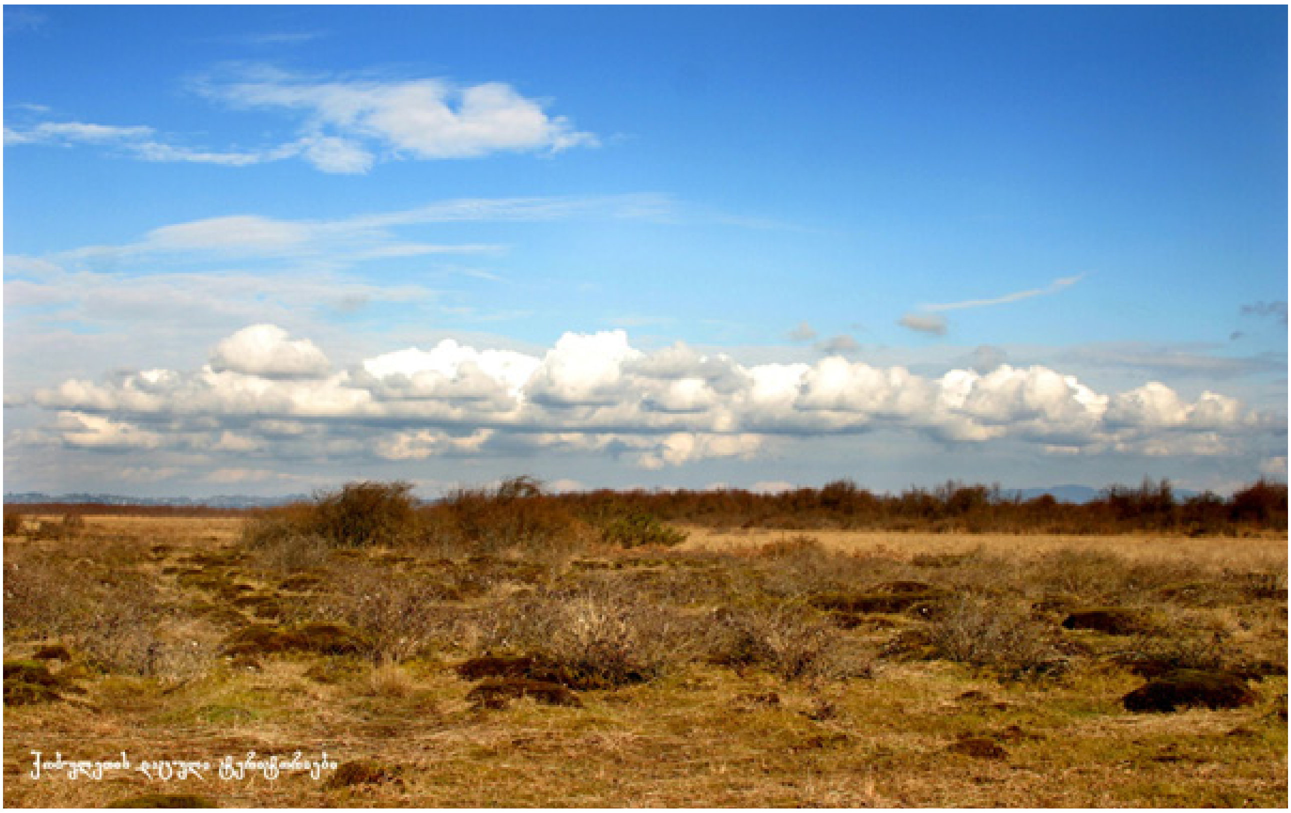

Figure 50. Peatland landscape at Ispani 2 Mire, Ispani nominated component area. (Photo: Izolda Matchutadze)

The bog (250 ha) consists of a 160 ha large open part, surrounded by a margin of *Alnus* shrubland. Ispani 2 is dome shaped with a 5 m height difference between bog centre and margins (Figure 51, 52). The mire is surrounded by the river Togona to the North and East, and by the river Shavi Gele to the South and West. The bog borders on Ispani 1 to the South. Other land adjacent to the mire is used as arable or pasture land and partly laying fallow. The bog is not drained, except for some minor ditches in the margins, but has suffered from channel construction in the SE part in the 1950s (pers. comm. Gurami Kotrikadze, Department of Drainage of Adjara, drainage maps). There may also have been minor impacts of the recent deepening of the Togona river (Grootjans et al. 2016).

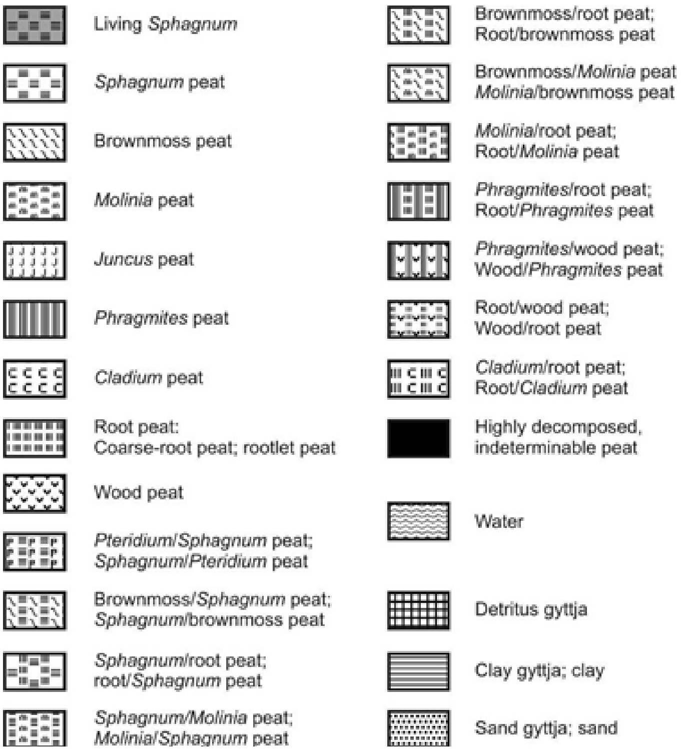
Living Sphagnum
Sphagnum peat
Brownmoss peat
Molinia peat
Juncus peat
Phragmites peat
Cladium peat
Root peat: Coarse-root peat; rootlet peat
Wood peat
Pteridium/Sphagnum peat; Sphagnum/Pteridium peat
Brownmoss/Sphagnum peat; Sphagnum/brownmoss peat
Sphagnum/root peat; root/Sphagnum peat
Sphagnum/Molinia peat; Molinia/Sphagnum peat
Brownmoss/root peat; Root/brownmoss peat
Brownmoss/Molinia peat Molinia/brownmoss peat
Molinia/root peat; Root/Molinia peat
Phragmites/root peat; Root/Phragmites peat
Phragmites/wood peat; Wood/Phragmites peat
Root/wood peat; Wood/root peat
Cladium/root peat; Root/Cladium peat
Highly decomposed, indeterminable peat
Water
Detritus gyttja
Clay gyttja; clay
Sand gyttja; sand

Figure 51. Legend for all peat profiles.

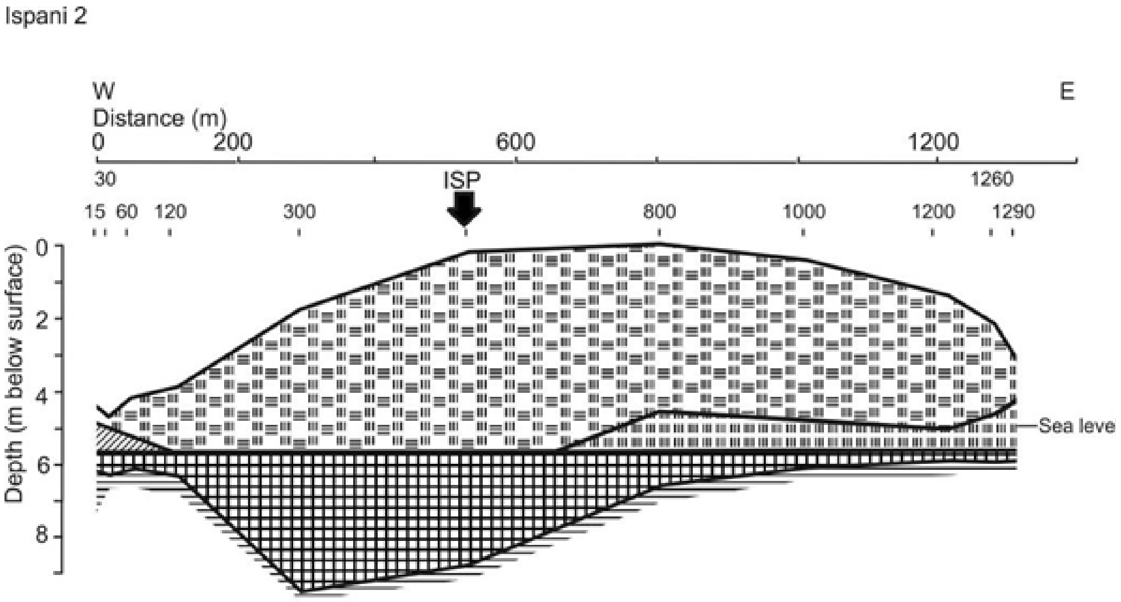

Figure 52. Peat profile of Ispani 2 Mire with the location of core ISP (De Klerk et al. 2009).

Ispani 2 Mire, which is protected as a managed reserve (IUCN PA Management Category IV), borders Ispani 1 Mire, and forms part of the buffer zone of the proposed property.

Development, structure and function of Ispani 2 Mire

The sediments beneath the peat in Ispani 2 consist mainly of clay and detritus gyttjas that were deposited between 5,750 and 2,525 cal yr BP (3,800 – 525 BC, De Klerk et al. 2009.) The fine texture of the sediments indicates a stagnant water regime or low flow velocities (Hjulström 1935) in the water body of the former lake or lagoon.

Peat formation started approximately 2,525 cal yr BP (De Klerk et al. 2009). The peat stratigraphy reflects a fen phase dominated by Cyperaceae partly accompanied by *Phragmites* and *Alnus* that terrestrialized the open water area (lithogenous immersion mire sensu Joosten & Clarke 2002). Rainwater influence in this fen gradually increased to develop a *Sphagnum*/Cyperaceae root peat with initial bog character. Whereas a *Sphagnum*/*Molinia* peat with *Sphagnum papillosum*, *S. palustre* and *S. austinii* increased since around 1,800 cal yr BP/AD 150, a real raised bog with a dominance of *Sphagnum austinii* came only into being around 1,000 cal yr BP(AD 950). This peat layer is hardly decomposed and has accumulated with a rate of over 4 mm per year (Joosten et al. 2003). **The current mire can be described as a percolation bog (sensu Joosten & Clarke 2002) and may be considered as the 'type locality' of the hydrogenetic mire type *percolation bog* (Krebs et al. 2017).**

Physical and chemical conditions: The macrorelief of Ispani 2 shows a dome shape with 5 m height difference between bog centre and margin (Kaffke 2008). The microrelief consists of hummock and hollows at the mire margin and *Sphagnum* lawns in the centre. The pH of the upper peat layer is around 3.5 with negligible differences over the mire. The low C/N ratios ranging from 18–26 in the upper peat layer, correlating with a high N content, are remarkable for an ombrotrophic bog but can be explained by input of windblown material from surrounding agriculture and the regular burning of the peatland (Kaffke 2008). The degree of humification of the peat is low (H2-H3) over large depths in the centre of the mire and higher at the margins (Kaffke 2008). Water levels clearly increase and water level fluctuations decrease going from the bog edge to the centre (Kaffke 2008). One characteristic feature of Ispani 2 mire is the very high mire oscillation capacity (*Mooratmung*, Weber 1902), which compensates absolute water level fluctuations leading to permanent high relative water levels.

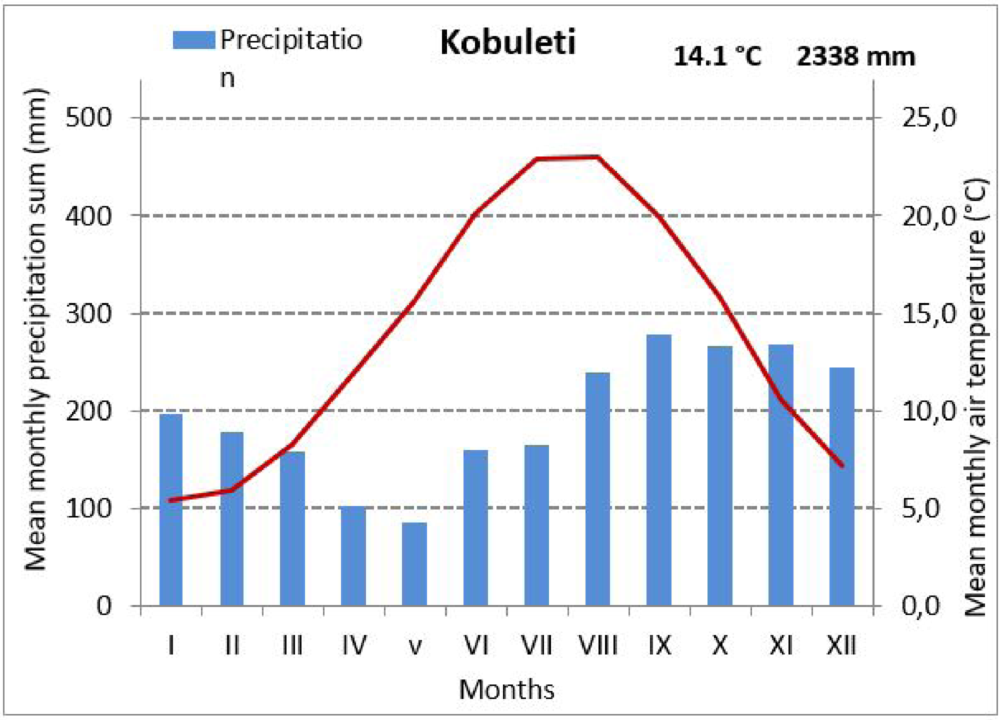

Figure 53. Climate diagram of Kobuleti, near Ispani nominated component area. Source: Climate station Kobuleti, 1971-2003 (temperature), 1955-2005 (precipitation).

Climate

The climate of Ispani nominated component area is warm-temperate and highly humid, with 2,338 mm of annual precipitation and a precipitation maximum in autumn (Figure 53).

Hydrology

The percolation bog at Ispani 2 nominated component area is fed by atmospheric precipitation. It has a weak hydrological connection to the Shavi Ghele River. The proximity of the Black Sea coast (ca. 1.2 km at the nearest point) has a strong stabilizing effect on the water level at and around Ispani 2 Mire.

Ecosystems and vegetation

The Ispani nominated component area is dominated by a percolation bog, a special type of peatland ecosystem that is only found in the Colchic Lowlands (see Section 2.a.1 – ecosystems, habitats and vegetation).

In terms of vegetation, the margin of the Ispani 2 Mire consists of trees dominated by *Alnus barbata,* accompanied by *Frangula alnus* with *Smilax excelsior*, *Rubus* and *Sphagnum palustre*. In the transition zone to the open mire, there are also relict the relict ferns *Osmunda regalis* and *Thelypteris palustris*, and shrubs (some of them colchic) such as *Rhododendron ponticum*, *Rh. luteum*, *Vaccinium arctostapyllus*, *Calluna vulgaris*.

The vegetation of the open mire is characterized by the associations of Sphagnetum-Molinietum, with Molinia litoralis dominance and four species of Sphagnum: Sphagnum austinii, S. papillosum, S. rubellum, and S. palustre. Association species are Rhynchospora alba and Drosera rotundifolia. Other accompanying species are Pteridium aquilinum, Rhododendron luteum, R. ponticum, Vaccinium arctostaphylos and Carex lasiocarpa (Kaffke 2008). Its cover of vascular plants and peat mosses reaches 30-60 % and 60-100 %, respectively in the open mire part (Figure 54). The height and cover of the vascular plant species decrease from the margin to the mire centre. The clear decrease in water level fluctuations from the bog edge to the centre seems to be responsible for this (Kaffke 2008) as prolonged near-surface water levels are unfavourable for vascular plants growth (Dierssen & Dierssen 2001). Another cause will be the decrease of nutrients going from the margin to the mire centre (Krebs & Gaudig 2005) as is indicated by the C/N values of the upper peat layer. The margin is influenced by periodical flooding by the adjacent river. The rather sharp border of the forested margin corresponds with the flooding level of the mire. The upper peat layer at the margin is also decomposed more strongly, leading to higher nutrient availability (Krebs & Gaudig 2005). (Figure 54)

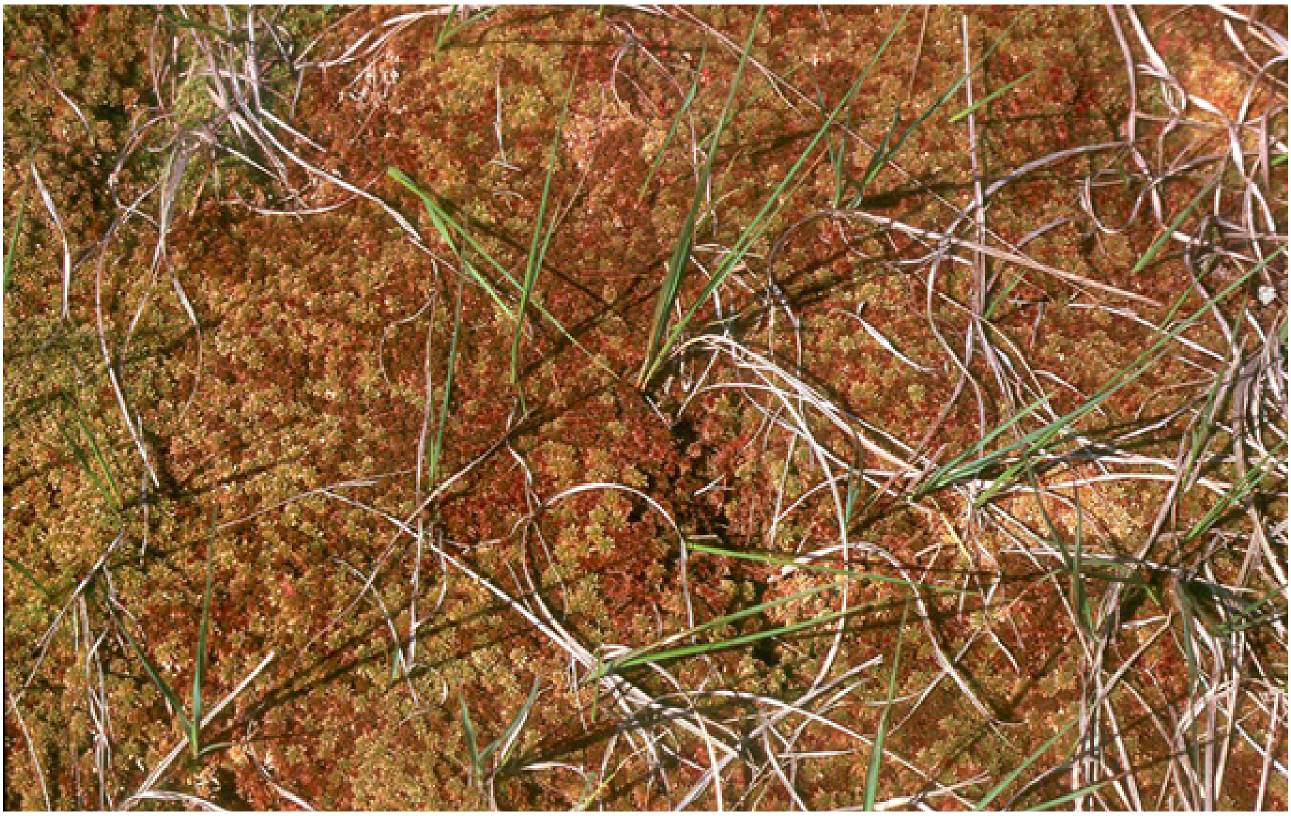

Figure 54. Vegetation of percolation bog Ispani 2, Ispani nominated component area, with *Sphagnum austinii, Sph.rubellum and Sph. papilosum.* (Photo: Matthias Krebs)

Flora

The species composition is largely explained by distance to the bog margin, ash content and C/N ratio, reflecting different nutrient availability, and to slope, reflecting different water levels (Kaffke 2008). The Ispani 2 Mire currently harbours – next to Tertiary relict species like *Rhododendron ponticum* and *Osmunda regalis* – several (sub-) mediterranean, temperate, and boreal relict species (Denk et al. 2001). Temperate and boreal mire flora elements include *Drosera rotundifolia, Menyanthes trifoliata*, *Rhynchospora alba* and *Carex lasiocarpa*. Among the main peat accumulating species, the very dense lawns of *Sphagnum* deserve special attention. The permanent high water level (see site conditions) leads to a very productive peat moss growth (Krebs & Gaudig 2005, Krebs et al. 2016). The dense *Sphagnum* lawns are dominated by *Sphagnum papillosum* accompanied by *S. austinii, S. rubellum,* and *S. capillifolium*. *Sphagnum palustre* grows here under ombrotrophic conditions, whereas the species elsewhere is restricted to minerotrophic sites (Daniels & Eddy 1985) (Figure 55). *Sphagnum austinii (imbricatum)* is a main peat forming species in Ispani 2 (Dokturowsky 1931, Dokturovskij 1936, Potskhishvili et al. 1997, Kaffke et al. 2000, De Klerk et al. 2009). In recent centuries, the species has become rare in many parts of Western Europe (Green 1968), its massive decline being ascribed to climate change, drainage, fires, grazing and eutrophication (Mauquoy & Barber 1999). Despite its decrease during the 20th century, the species is still common in Ispani 2. Currently the Ispani 2 mire harbours the main population of this peat moss species in the Colchic Lowlands. It further only occurs over small areas in the Ispani 1 and Imnati mires. The occurrence of *Calluna vulgaris* (Kaffke et al. 2002, Connor et al. 2007) and *Spiranthes amoena* (Akhalkatsi et al. 2004) in the flora of Ispani 2 is remarkable.

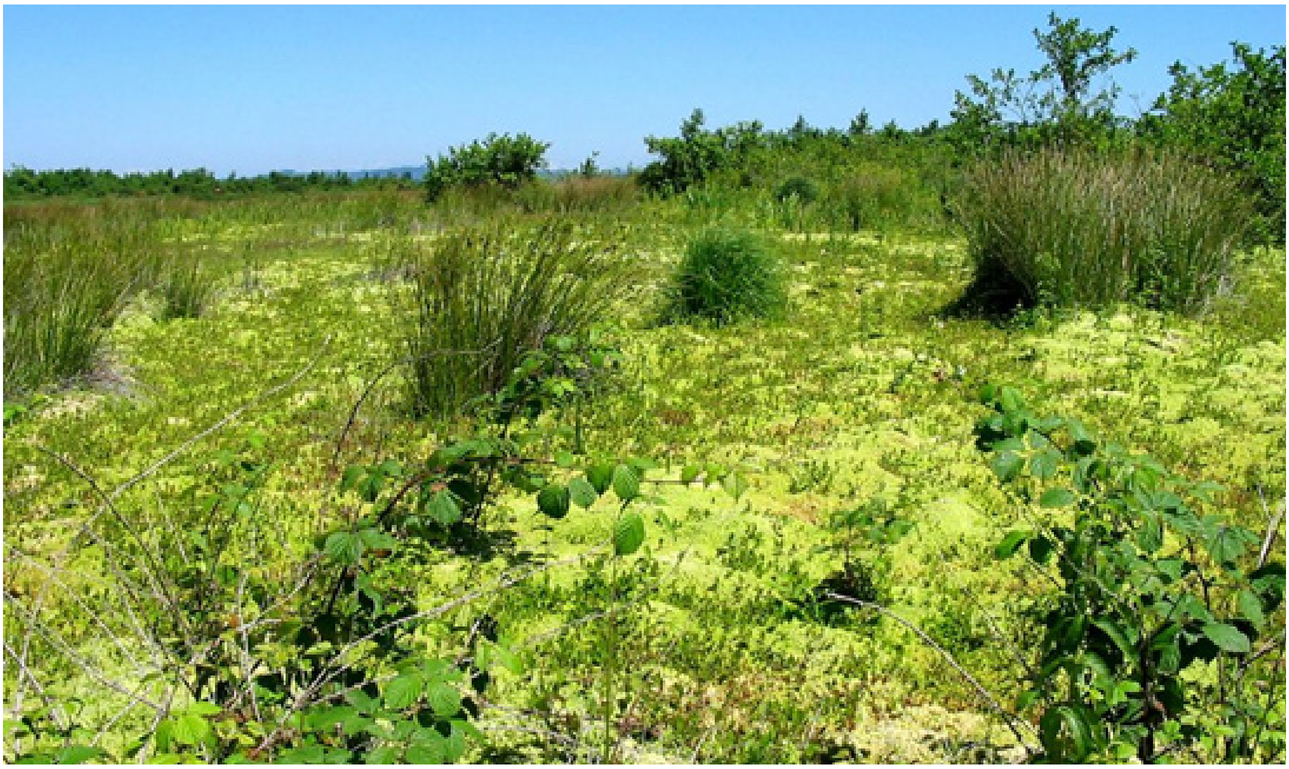

Figure 55. Peat mosses and vascular plants at Ispani 2 Mire, Ispani nominated component area. (Photo: Izolda Matchutadze)

Fauna

Ispani nominated component area contributes to the value of the series because it contains a percolation bog with its characteristic flora and vegetation. Its fauna has not been studied to the same extent as that of Mtirala-Kintrishi nominated component area or some of those within Kolkheti National Park, and is probably of relatively limited significance. Being a relatively small and uniform area without extensive tree cover, it is not important for larger mammals or any species of forest fauna (Tables 6-8, Appendix 3). Because of the lack of larger freshwater areas within or near the component area, it is also not an important resting area for migratory water birds.

2.a.5 Description of nominated component area No. 3: Grigoleti

Size, location and topography

Grigoleti nominated component area is situated around Grigoleti Mire east of the settlement of Grigoleti/Maltakva approximately 400 m from the Black Sea (Figure 4). The nominated component area has an extension of 125 ha a with a major part of open mire and very limited surrounding alder forests. The river Karpatsha is bordering the area to the North. Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

Development, structure and function of Grigoleti Mire

The mire is situated in a shallow basin. Its development started with the terrestrialization of a lagoon. The open water period is indicated by clay and detritus gyttjas (Figure 56). The terrestrialization is reflected by the accumulation of *Phragmites* peat and wood peat. The northern part of Grigoleti Mire is characterised by (mainly alder) wood peat and clay and detritus gyttja, indicating shifts between drier and open water periods, respectively. The southern part shows a very diverse sequence of thin layers of *Phragmites* peat, root peat and its mixtures, partly accompanied with wood remnants, indicating alternations of drier and wetter conditions. The part must have differed from the mainly forested northern area by its open character of small patches of sedges and *Phragmites* stands. As alder grows under drier conditions than *Phragmites*, it can be assumed that the southern part was subject to more constant wet conditions. The northern part must have been more strongly influenced by the nearby river Karpatsha. The changing water levels of the river caused by transgressions and regressions of the Black Sea lead to stronger shifts between wetter and drier periods in the mire.

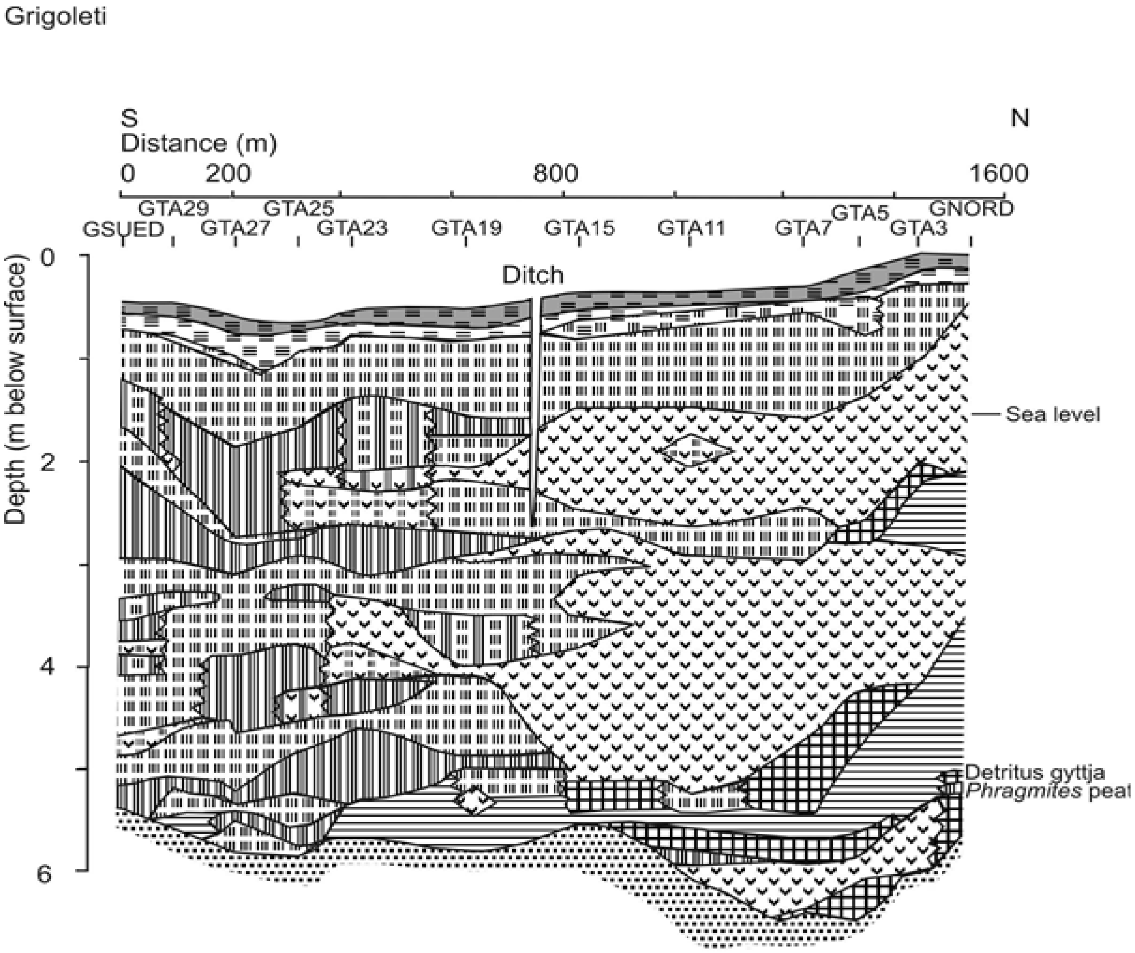

Figure 56. Peat stratigraphy of Grigoleti Mire along a South-North transect.

The upper peat layers consist of root peat and *Sphagnum* peat over the entire mire area, indicating similar, drier and non-forested conditions. The influence of the river had probably decreased when this was accumulated. The disappearance of the forest can be due to wood cutting and frequent burning, inhibiting the new growth of trees. The drier conditions are caused by the drainage of the mire. The decreased influence of lithogenous water, the abundant precipitation in the region, and the inhibition of tree growth in combination support the growth of *Sphagnum.*

The Grigoleti Mire can be characterised as a lithogenous water rise mire (sensu Joosten & Clarke 2002). *Sphagnum* has been growing for several years in a dense cover, and the accumulation of hardly decomposed *Sphagnum* peat illustrates the severe changes in the character of the mire. **At present the Grigoleti Mire shows similar conditions as the two percolation bogs Ispani 2 and Imnati. It is possible that the mire is an initial phase in the development of a percolation bog (sensu Joosten & Clarke 2002).**

Physical and chemical conditions: The mire has a slight slope from north to south. The microrelief mainly consists of peat moss lawns. Locally also hummocks and hollows occur, i.e. at the mire margins or on spots that recently have suffered from fire. The peat pore water is acid and nutrient poor conditions with pH-values of 4.26 - 5.65 and EC values of 22 - 134 µS cm^{-1} prevail. The C/N ratios of the upper peat range from 14 to 29, with a mean of 20. These values are rather low for bogs, indicating a higher nitrogen supply than normal. Kaffke (2008) attributes this – for the Ispani 2 bog - to fire decreasing the C/N values.

Climate

The climate of Grigoleti nominated component area is typical of the Colchic Lowlands, i.e., warm-temperate and highly humid, with ca. 2,000 mm of annual precipitation and a precipitation maximum in autumn (Figure 57).

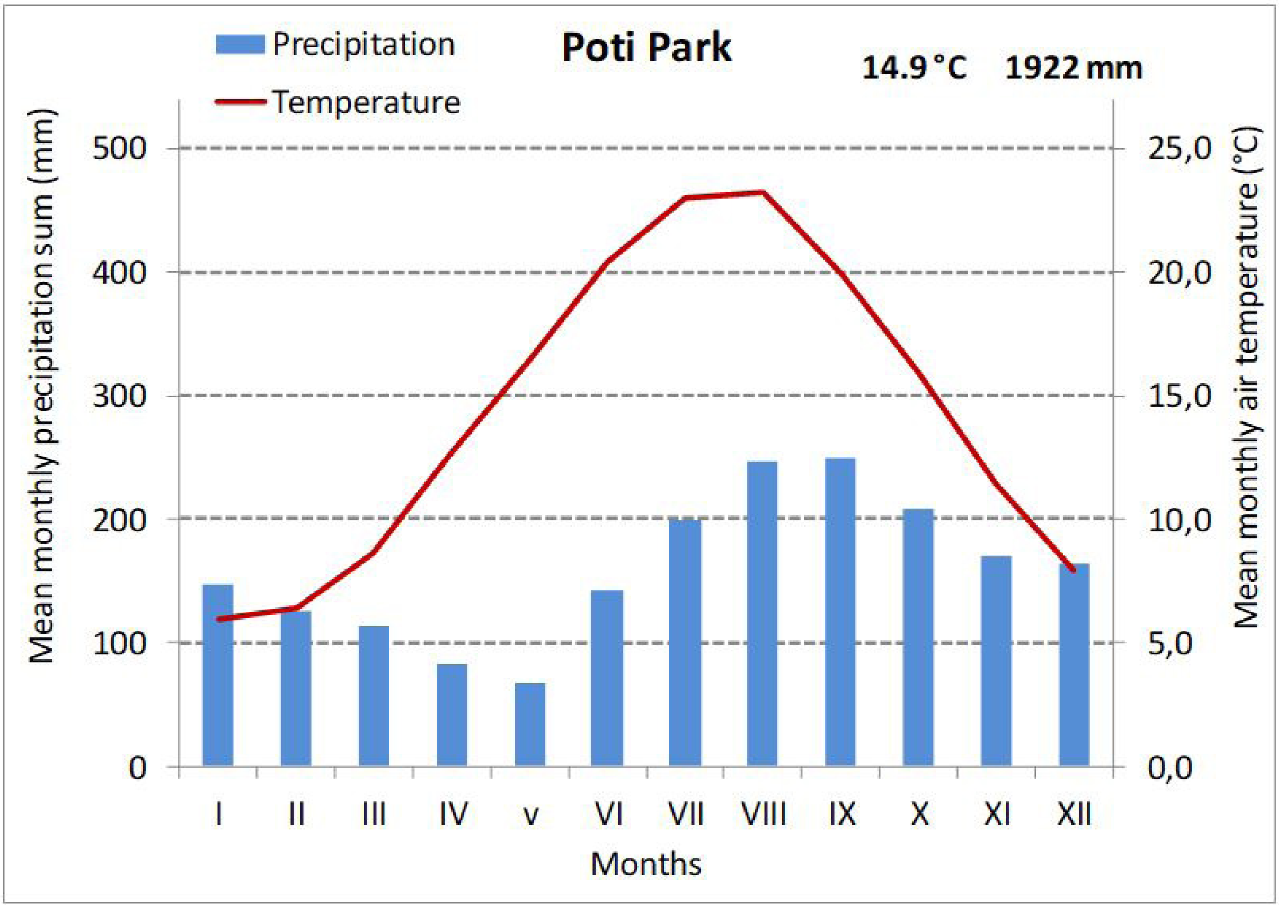

Figure 57. Climate diagram of Poti Park, near Grigoleti, Imnati, Pitshora, Nabada and Churia nominated component areas. Source: Climate station Poti Park, 1955-2006.

Hydrology

The peatlands at Grigoleti nominated component area are mainly fed by atmospheric precipitation. The mire has a weak hydrological connection to the Karpatsha River. The proximity of the Black Sea coast (ca. 400 m at the nearest point) has a strong stabilizing effect on the water level at and around Grigoleti nominated component area.

Ecosystems, habitats and vegetation

The nominated component area of Grigoleti is dominated by a percolation bog in statu nascendi. Some alder forest occurs along its margins. The vegetation is characterized by the formations of *Sphagnetum-Molinietum (Molinia litoralis), with Sphagnum papillosum, S. palustre, and Molinia litoralis, accompanied with Carex lasiocarpa and Rhynchospora caucasica* partly with Spiranthes amoena. It also comprises shrubs and sedges. The height of the vascular plants increases at the mire margins. A dense Sphagnum cover of around 80% and vascular plants with a cover of around 60% are characteristic for the vegetation of Grigoleti Mire.

Flora

The flora of Grigoleti Mire and surroundings is broadly similar to that of Imnati Mire (see Section 2.a.5 below), and typical of the Colchic mire flora as described in detail in Section 2.a.1 (flora). *Cladium mariscus* grows in stands of several m^2 locally.

Fauna

Similar to Ispani, Grigoleti nominated component area has been included into the series mainly because of its special Colchic mire ecosystem with its characteristic flora and vegetation. Its fauna is of relatively limited significance to the overall values of the series, as it is also rather small, open, and devoid of larger freshwater areas (Table 6-8).

2.a.6 Description of nominated component area No. 4: Imnati

Size, location and topography

The proposed component area of Imnati (3,418 ha) is located around a mire complex of the same name (Figure 58), which is situated 5 km east of Poti and adjacent to the eastern shoreline of Lake Paliastomi in the centre of a former lagoon (Figure 5). Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

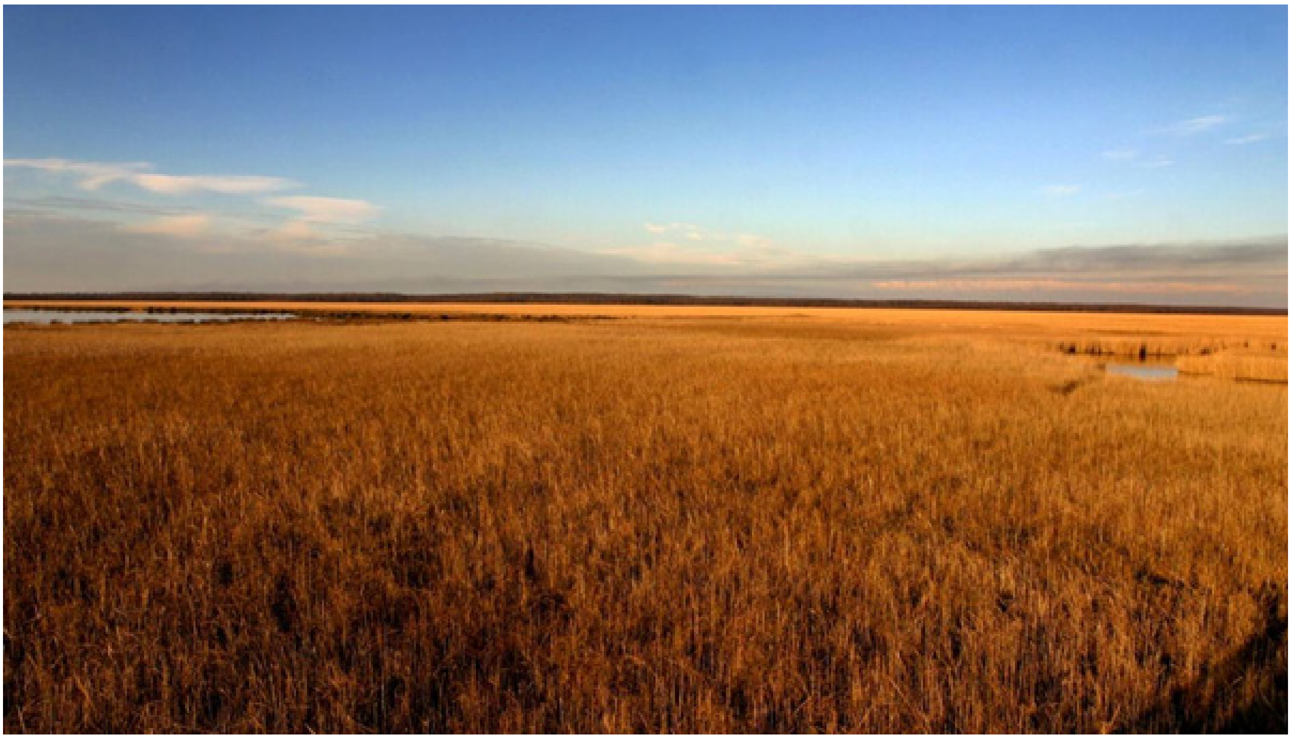

Figure 58. Landscape at Imnati mire with intermittent freshwater bodies. Photo: Izolda Matchutadze.

The complex comprises 3,800 ha non-forested peatland with two raised peat cupolas, plus small areas of Colchic lowland forest along the northern and north-eastern edges of the mire. The raised peat cupola between Lake Paliastomi and Lake Imnati rises approximately 5 m above the surrounding peatland (Figure 59. East of Lake Imnati, a second raised peat body of smaller size is located. North of the peat cupolas an open peat moss/sedge mire plain stretches for 2 km until the marginal forests. In the South, the nominated component area is confined by the channels Cherpalka and Tkhorina and by adjacent forests.

Development, structure and function of Imnati Mire

The sediments beneath the peat in Imnati consist mainly of stratified silt and clay gyttjas with enclosed sand gyttja layers (Figure 59). They show upward decreasing carbonate contents. The fine texture of the sediments indicates a stagnant water regime or low flow velocities (Hjulström 1935) in the water body of the former lagoon. Layers of sand gyttja reflect the periodically stronger influence of the Rioni River, which had from the eastern side direct access to the lagoon via the recent back water, named Orpiri Rioni, which fed the lagoon with carbonate rich glacial abrasion material from the Caucasus mountains. Closer to the Black Sea periodically marine influence was possible until 5,000 – 6,000 BP, i.e. before a spit separated the lagoon from the sea (Potskhishvili et al. 1997).

Peat formation in Imnati began approx. 6,000 BP (6247 cal.BP at 10.25 m depth at core 1860). The peat stratigraphy reveals two major phases of mire development. The *Phragmites* / coarse root and rootlet peat and the coarse root and rootlet peat reflect a fen phase dominated by *Phragmites* and Cyperaceae reeds that occupied and finally closed the shore lake (lithogenous immersion mire sensu Joosten & Clarke 2002). The fen prevailed for a long period (6,247 - 2,943 cal. BP) during which water level and nutrient rich conditions will have been stabilized by the high tectonic subsidence rates of the central Colchis costal area (actual annual rates near Poti are 6.5 mm; Potskhisvili et al. 1997). As a consequence, the runoff of the feeding rivers was hampered and the fen water level rose synchronously with the growing fen peat (lithogenous water rise mire sensu Joosten & Clarke 2002).

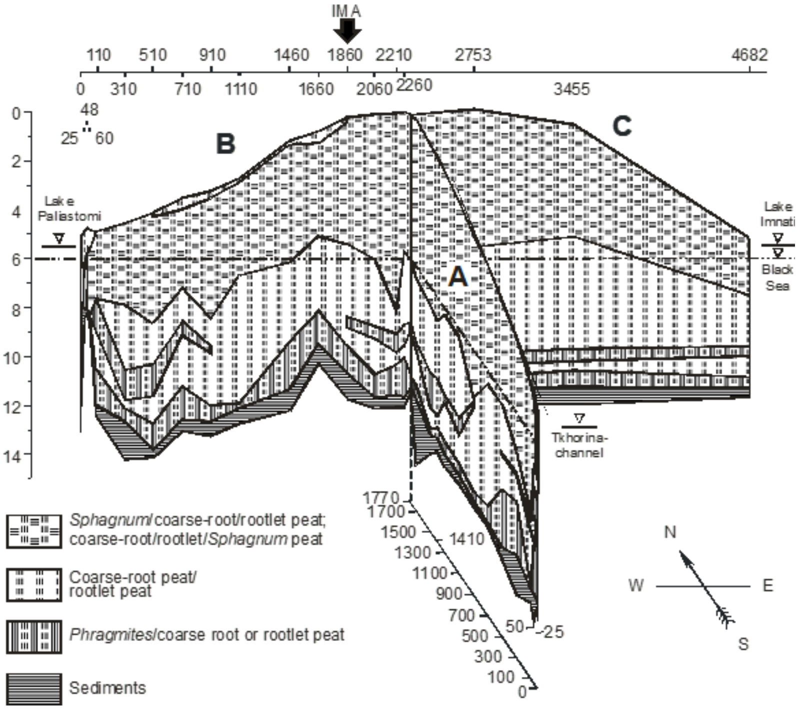

Figure 59. Stratigraphy of the Imnati mire along two coring transects from west to east and from north to south. (Haberl et al. 2006)

Around 2,943 cal.BP (5.85 m depth in core 1860) the formation of highly decomposed *Sphagnum* peat started under more acid and nutrient poor conditions, indicating that the mire water level was gradually decoupled from that of the surroundings, the influence by precipitation increased and changed towards an ombrogenous regime. A loosely arranged, hardly mummified *Sphagnum* (mixed) peat accumulated with a high root content mainly from *Molinia litoralis*, *Carex rostrata* and *Carex lasiocarpa* but also from Ericaceae (*Rhododendron ponticum*, *Rh. luteum*). These roots and rootlets cause the loose peat to maintain a high permeability over significant depths of the bog peat body. **The Imnati Mire is described as a percolation bog (Joosten & Clarke 2002) the largest representative of this type.**

Physical and chemical conditions: The centre of Imnati shows hardly microrelief and largely consists of *Sphagnum* lawns. At the mire margins a differentiation in hummock and hollows indicates a stronger lateral water flow near the surface. The phreatic water level in Imnati is quite high over the entire area (Kahrmann & Haberl 2005, Krebs et al. 2016).

The pH of the upper pore water amounts to 4.0-5.5. The EC (Electric conductivity) values of the pore water to 1 m depth range from 40- 70 µS cm^{-1}. Both values point at ombrotrophic conditions. The C/N ratio of the peat (10 cm deep) has values from 9.8-51.6 indicating mesotrophic and oligotrophic conditions.

Climate

The climate of Imnati nominated component area is warm-temperate and highly humid, with ca. 1,900 mm of annual precipitation and a precipitation maximum in late summer and early autumn (Figure 57).

Hydrology

The peatlands and forests at Imnati nominated component area are fed by atmospheric precipitation. The mire has a hydrological connection to the Pitshora River system and to Lake Paliastomi, which in turn is connected to the Black Sea. The proximity of the Black Sea coast (ca. 3 km at the nearest point) has a stabilizing effect on the water level at and around Imnati nominated component area.

Ecosystems, habitats and vegetation

The nominated component area of Imnati nominated component area is dominated by Imnati Mire, the largest and oldest percolation bog. Some limited areas of Colchic lowland forest and open freshwater bodies are also included.

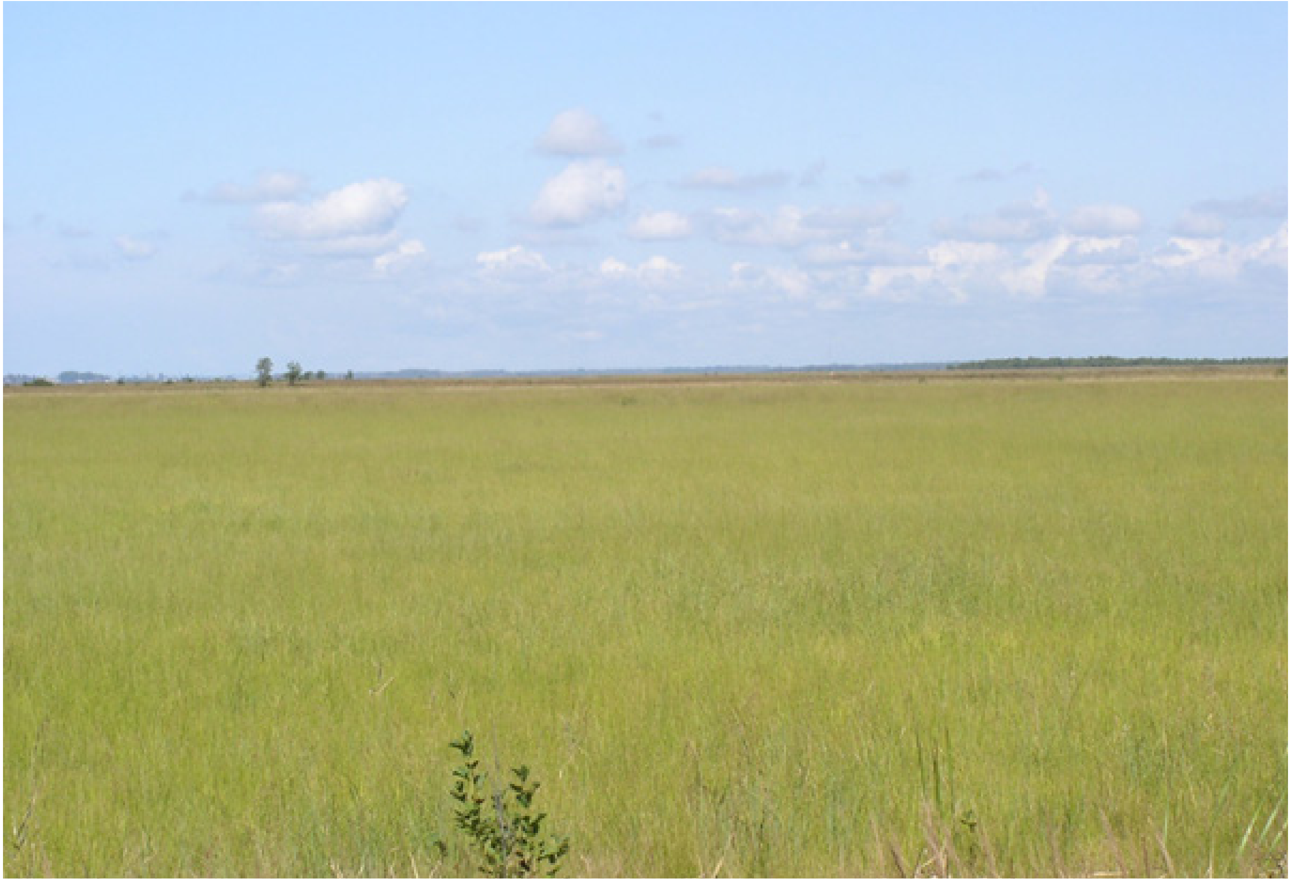

Figure 60. Sphagnetum-Cladietum mariscus at Imnati nominated component area. (Photo: A. Haberl)

The vegetation of Imnati Mire is characterized by the formations of Sphagnetum-Cladietum mariscus (Figure 60), with *Sphagnum papillosum, S. magellanicum, S.rubellum, S. palustre some small patches of Sphagnum austinii, Cladium mariscus, Molinia litoralis, Carex lasiocarpa.* At the periphery of the mire association are relict ferns such as *Osmunda regalis, Thelypteris palustris,* and other relict species such as *Menyanthes trifoliate.* There are also some ponds and lakes interspersed in Imnati Mire (Figure 61), which are dominated by *Nymphaea colchica and Salvinia natans.*

Typical is the association of these peat mosses with the grass *Molinia litoralis* and dwarf shrubs like *Frangula alnus*, *Rhododendron ponticum* and *Rh. luteum* (Dokturovski 1931). A characteristic feature are the stands of *Cladium mariscus* prospering on 5 m of *Sphagnum* peat under fully ombrotrophic infiltration conditions in the central parts of the western cupola (Figure 59 , Haberl et al. 2006).

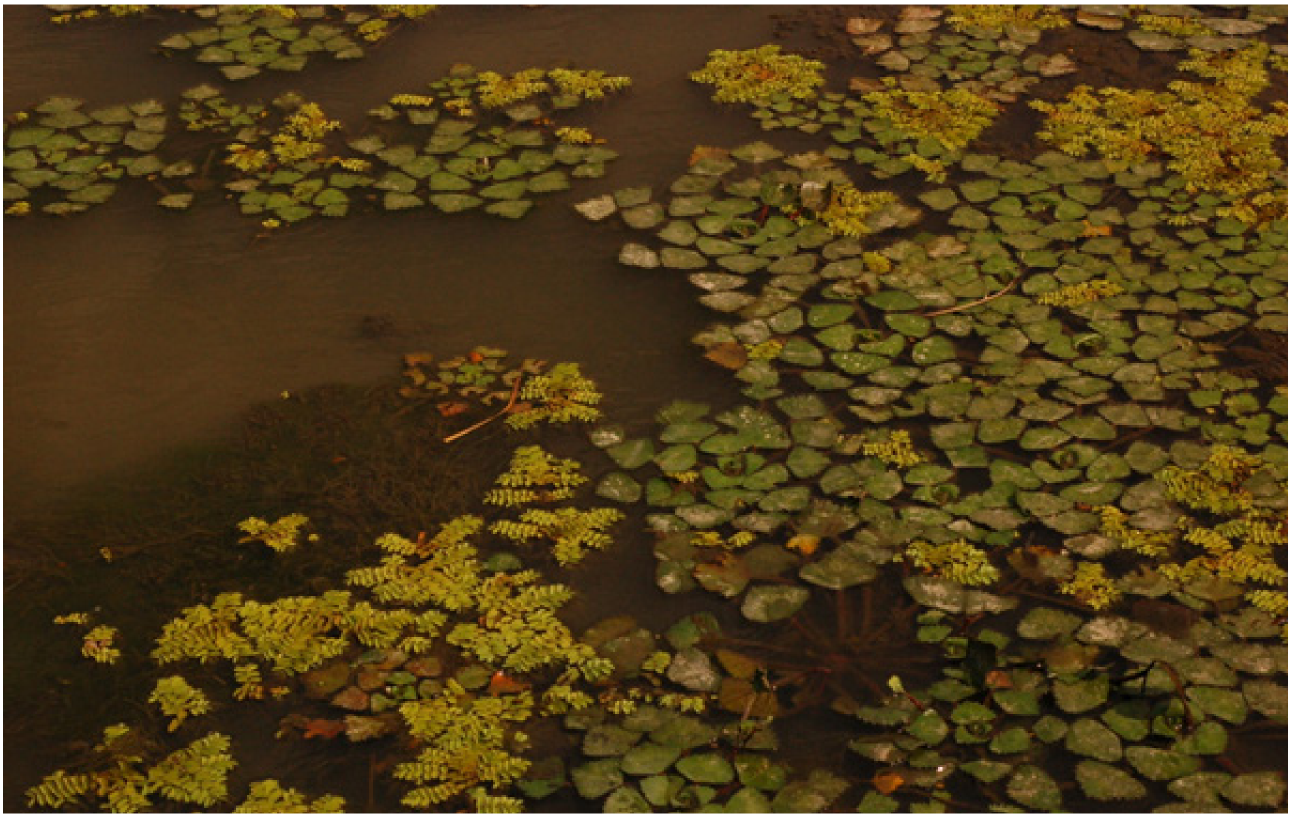

Figure 61. Freshwater ponds dominated by *Salvinia natans and Trapa natans* at Imnati nominated component area. (Photo: Hans Joosten)

Flora

The flora of the Imnati Mire is made up of 70 moss and vascular plant species (Table 4, Appendix 2). It is typical of the peatland flora of the Colchic Lowlands.

Fauna

In addition to a large percolation bog with a species-poor fauna, Imnati nominated component area contains significant Colchic lowland forest and open water bodies. The forest makes it an important habitat for lowland forest fauna (e.g. bats, herpetofauna), while the open water areas within this nominated component area and its buffer zone contribute to the importance of the area for ichthyofauna, migratory as well as breeding waterbirds, as described in more detail in Section 2.a.1 (fauna). The area is also important for freshwater invertebrates. 126 species of waterbirds (incl. shorebirds) have been recorded there, including 18 globally threatened and near-threatened species (Appendix 3.2.a, 3.2.b).

2.a.7 Description of nominated component area No. 5: Pitshora

Size, location and topography

Pitshora nominated component area (2,393 ha) includes Pitshora Mire, which is situated 3 km north east of Lake Paliastomi, to the north of the Imnati Mire, and its surroundings. Both mire complexes are divided by the river Pitshora (Figures 5, 62). Further information on the boundaries of Pitshora Mire is presented in the textual description of boundaries in the Executive Summary.

The Pitshora Mire has an open part and a forested part with alder, like the Imnati Mire.

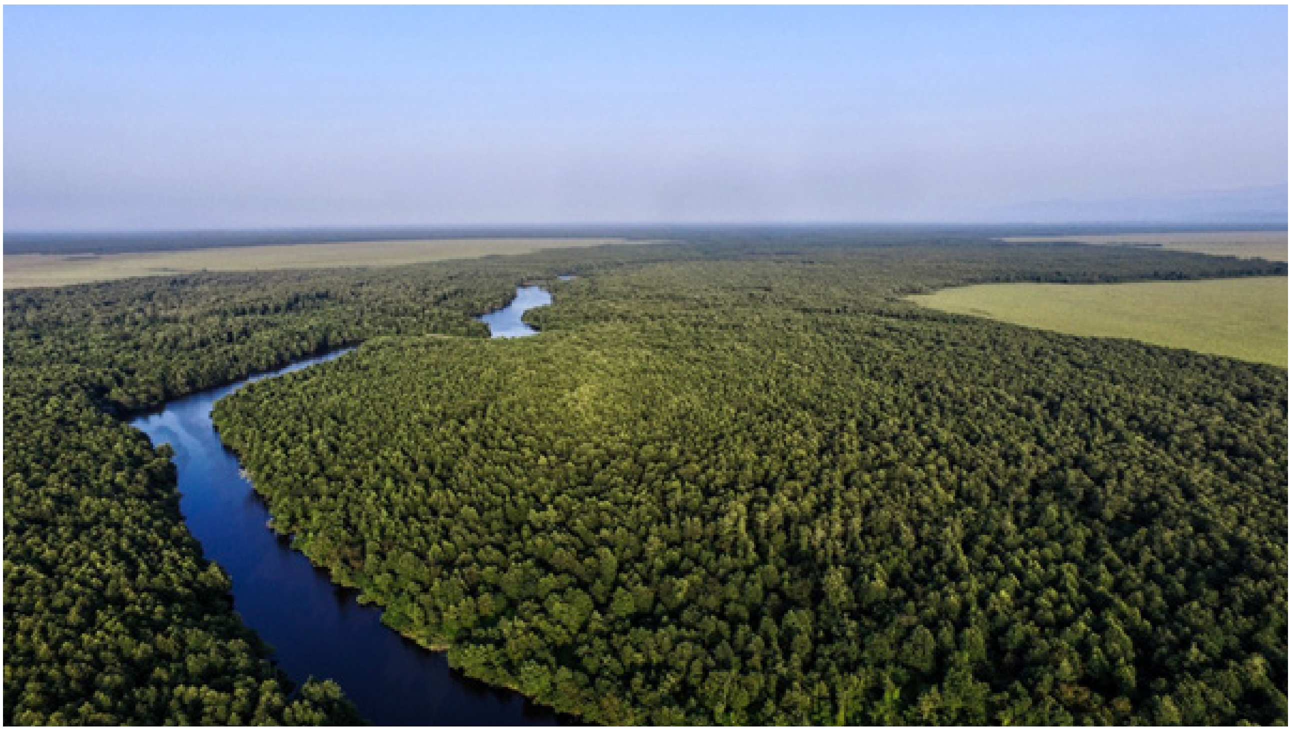

Figure 62. Aerial view of the landscape of the Colchic Lowlands along the Pitshora River, with forest and peatland areas within Imnati and Pitshora nominated component areas. (Photo: Paata Vardanishvili)

Development, structure and function of Pitshora Mire

The peat accumulation in Pitshora Mire started after an open water phase with a decreasing influence of streaming water, as is indicated by the sand, sand gyttja and clay gyttja (Figure 63). Later a forest established, probably due to drier conditions. Since then the Pitshora Mire has developed as a lithogenous water rise mire (Joosten & Clarke 2002) with wetter and drier periods as is indicated by the alternations of *Phragmites* peats and root peats.

The upper peat player is strongly decomposed. This is probably attributable to drainage by the channels that were excavated in the middle of the 20th century and to frequent burning by hunters in the last century. However, these threats have now largely seized.

Despite that the Pitshora Mire is situated close to Imnati Mire, their mire development is strongly different. We assume that both mire areas have always been separated by Pitshora River or its precursors, causing different hydrological conditions for mire formation. **An increase of *Sphagnum* cover has been observed recently at Pitshora Mire, justifying its classification as a potential precursor of the typical percolation bogs of the series and an important step within the succession of Colchic mire types (cf. Figure 24).**

Physical and chemical conditions: The macrorelief of the Pitshora Mire shows a slight cupola in its centre. The microrelief consists of tussocks and hollows. The pH value of the pore water of 5 and the EC value of 47 µS cm^{-1} indicate acid and nutrient poor conditions.

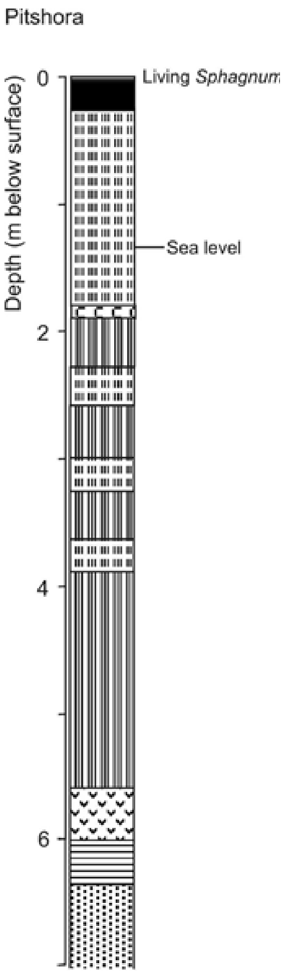

Figure 63. Stratigraphy of Pitshora Mire.

Climate

The climate of Pitshora nominated component area is typical of the Colchic lowlands, i.e., warm-temperate and highly humid, with ca. 1,900 mm of annual precipitation and a precipitation maximum in late summer and early autumn (Figure 57).

Hydrology

The peatlands and forests at Pitshora nominated component area are fed by atmospheric precipitation. The mire has a hydrological connection to the Pitshora system. The proximity of Lake Paliastomi, which is itself connected to the Black Sea (ca. 3 km at the nearest point) has a stabilizing effect on the water level at and around Pitshora nominated component area.

The mire was influenced by several channels draining from north to south in the past. As these channels are not cleaned anymore, their draining effect has decreased substantially, and is expected to decrease more in the future.

Ecosystems, habitats and vegetation

Pitshora nominated component area comprises Pitshora Mire, which can be considered a percolation bog *in statu nascendi*, and bordering areas of Colchic lowland forest.

The vegetation of Pitshora Mire belongs to the formations of *Sphagnetum-Molinietum* with *Molina litoralis, Carex acutiformis, C. pallascens, C. panicea, Cladium mariscus* and also the endemic *Solidago turfosa*. The mire is characterized by a dense cover of sedges and moor grass. Important species are summarized in Appendix 2. *Sphagnum denticulatum* and *S. palustre occur* in some parts with low, but increasing covers.

The Colchic **relict** forest of Pitshora (see Figure 64 for a schematic overview) nominated component area is dominated by the Colchic-Hyrcan relict *Alnus glutinosa spp. barbata* overall but contains many other relict woody taxa including *Acer orthocampestre* (Figure 65), *Quercus hartwissiana* (Figure 66), *Carpinus betulus, Morus nigra, Pterocarya fraxinifolia, Carpinus betulus, Ilex colchica, Morus nigra, Ficus carica, Ilex colchica, Ruscus ponticus, Humulus lupulus, Clematis vitalba, Smilax colchica, and Periploca graeca* (Denk et al. 2001, Matchutadze & Davitashvili 2003, Matchutadze et al. 2010a, b, Matchutadze et al. 2012). In very wet areas with mixed peat and clay soil there is also a less diverse swamp alder forest.

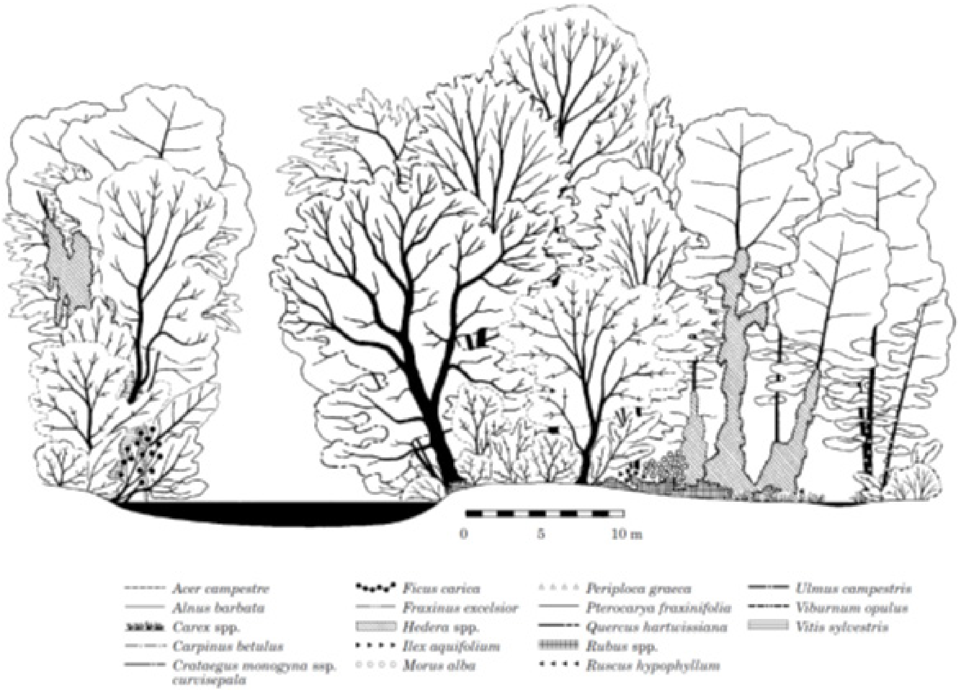

Figure 64. Vegetation transect showing typical Colchic lowland forest of Pitshora nominated component area. (Denk et al. 2001)

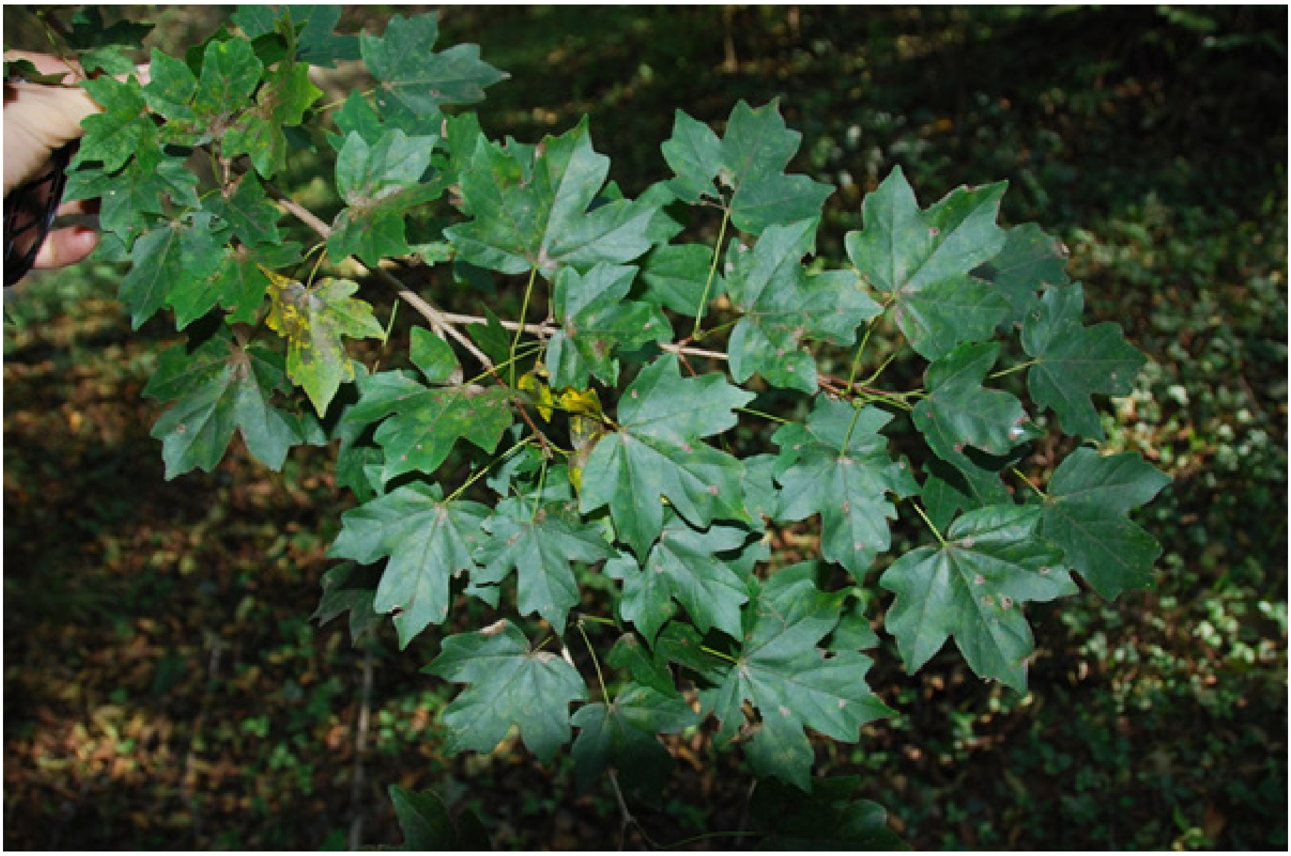

Figure 65. The relict tree *Acer orthocampestre* at Pitshora nominated component area. (Photo: Tobias Garstecki)

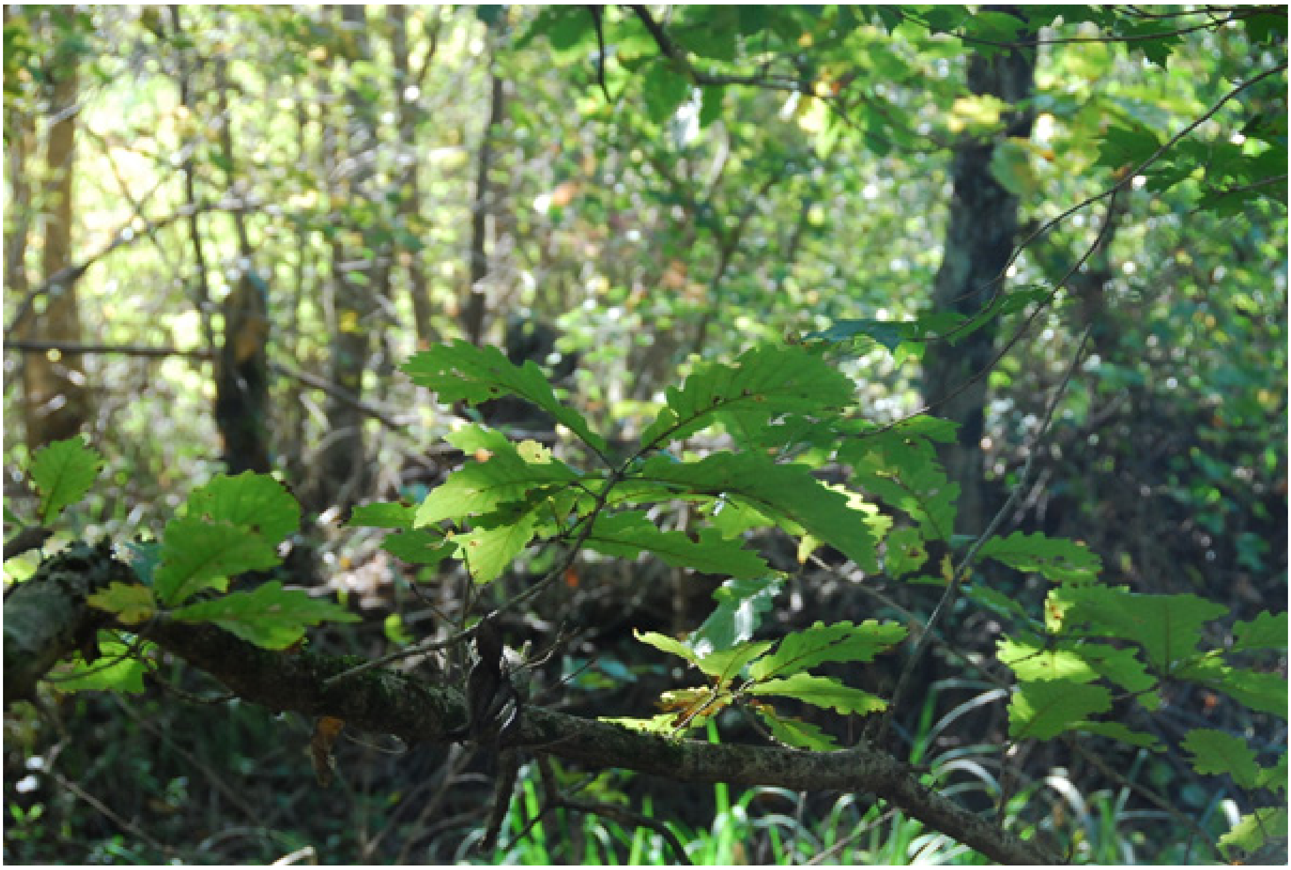

Figure 66. The Strandzha oak *(Quercus hartwissiana),* a relict species, in the Colchic lowland forest at Pitshora nominated component area. (Photo: Tobias Garstecki)

Flora

The flora of Pitshora Mire has not been studied to the same extent as that of Ispani, Imnati and Churia mires. It shows considerable overlap with that of other Colchic lowland mires (Appendix 2), and a subset of the species as listed for these areas in Appendix 2. The forest flora of Pitshora Mire is distinguished by a various Colchic relict species (Appendix 2).

Fauna

Pitshora nominated component area contains significant Colchic lowland forest and some open water bodies (the latter mainly within the forest), in addition to peatland habitats. This means that its typical fauna of lowland forests is similar to that of Imnati. In contrast, open water areas are more limited although they also have some importance for ichthyofauna and waterbirds.

2.a.8 Description of nominated component area No. 6: Nabada

Size, location and topography

The Nabada nominated component area (2,976 ha) is located north of the settlement of Poti and bordered to the West by the Black Sea and to the South by the river Rioni (Figures 1, 6). It is centred around the Nabada Mire complex (Figure 67), which consists of three parts (north, east and south). These are divided by the river Ziwa and its tributaries and channels.

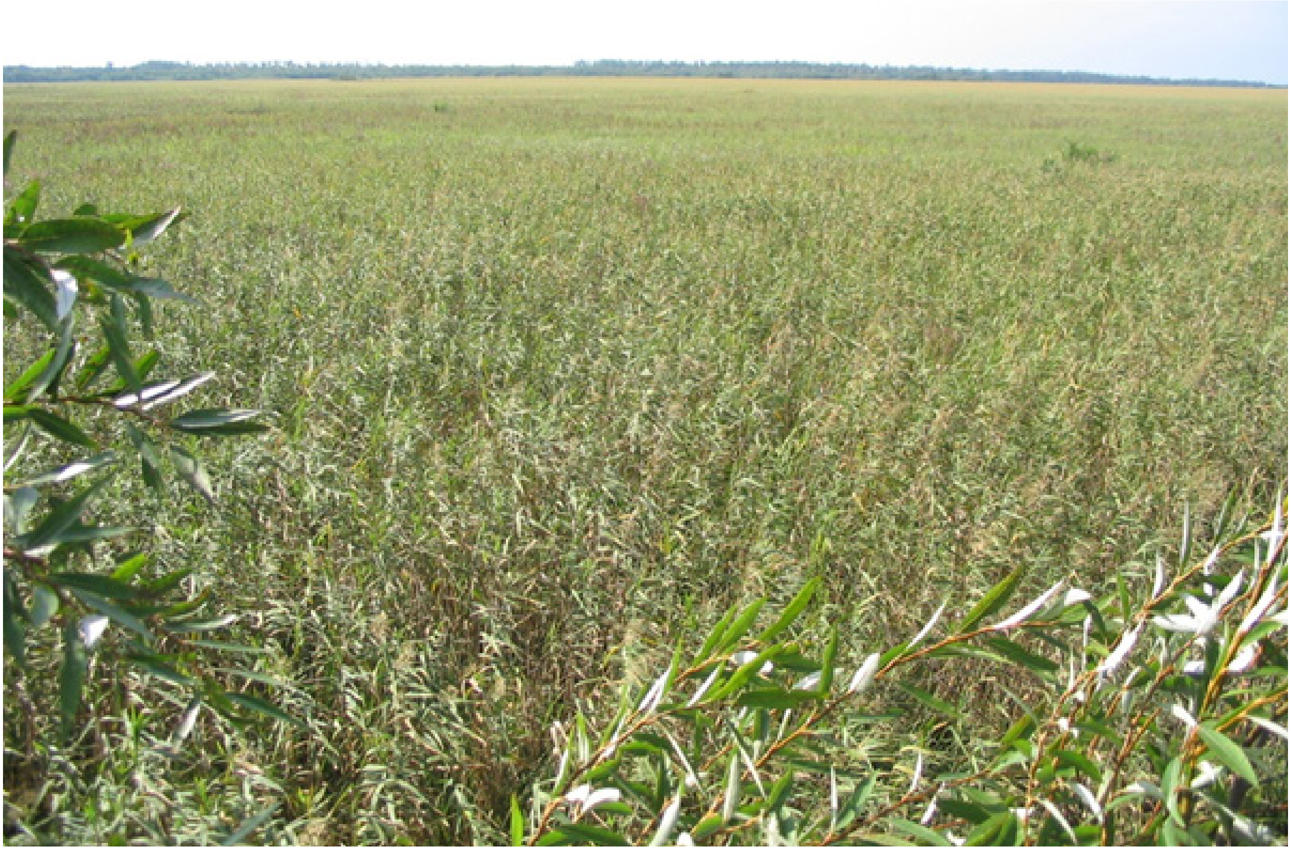

Figure 67. Landscape at Nabada nominated component area. (Photo: Izolda Matchutadze)

The mire has an extension of 7.5 km from North to South and 8.0 km from West to East. Besides the Imnati Mire, it is the largest open peatland area of the Colchic Lowlands, with 3,300 ha open peatland area. Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

Development, structure and function of Nabada Mire

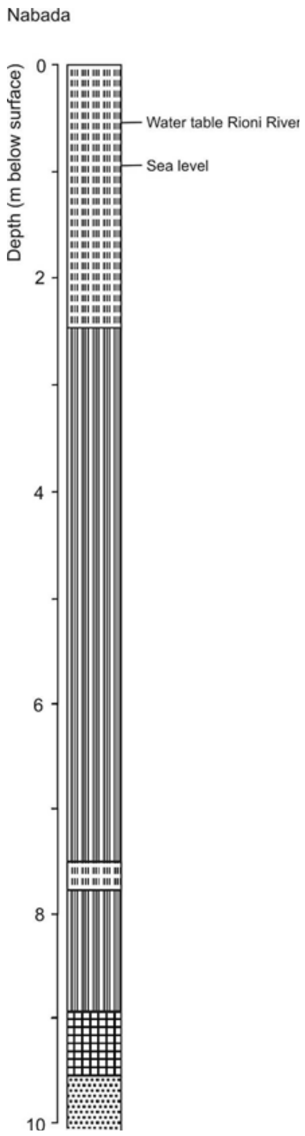

Figure 68. Stratigraphy of Nabada mire.

The mineral subsoil of Nabada is formed by sand and sand gyttja (Figure 68). The detritus gyttja reflects a period of open water but the presence of only little amounts of sand or silt show that little flow energy was involved. Probably the area also belonged to a lagoon like the area of the Imnati Mire. The lagoon terrestrialized with *Phragmites* stands. Peat accumulation began between 6,930 and 5,230 BP (Timofejew & Bogolyubowa 1998) in a lithogenous immersion mire (sensu Joosten & Clarke 2002). **After terrestrialization Nabada Mire has continued as a lithogenous water rise mire (sensu Joosten & Clarke 2002) in which nutrient rich and wet conditions prevailed.** This is shown by the continuous accumulation of *Phragmites* peat for long periods. High contents of fine sand or silt in the peat imply the influence of flowing water. Root peats with less *Phragmites* indicate periods in which water level was not rising that rapidly, probably because of regression of the Black Sea (Chepalyga 1984), or less water supply by the rivers due to river bed changes.

The recent peat layers reach a thickness of 13 m with a mean value of 6 m, i.e. the thickest recent peat layer of the mires of the Colchic Lowlands (Menagarishvili 1949, Buatshidse 1963). Its peat accumulation rate is estimated at 1.2 mm a^{-1} (Dshanelidse 1989). This mire might be one of the oldest of the Colchic Lowlands.

Physical and chemical conditions: The northern part of the mire is nearly flat. The eastern part slightly slopes from East to West. A cupola in the southwest of the southern part close to the Black Sea forms slopes to all directions. The micro-relief of Nabada Mire is characterised by tussocks with partly open water in between. The pH of the upper pore water is neutral (6.7). The low EC-value (140 µs cm^{-1}) indicates mesotrophic conditions. The nutrient richer and wetter conditions are reflected by stands of *Phragmites australis* also in more central parts of the mire.

Climate

The climate of Nabada nominated component area is typical of the Colchic Lowlands, i.e. warm-temperate and highly humid, with < 1,900 mm of annual precipitation (Figure 57).

Hydrology

The peatlands and forests at Nabada nominated component area are fed by atmospheric precipitation and river water. The mire has a hydrological connection to the Khobi River system to the north. Due to past, now discontinued channel digging from the Rioni in the south, periodical floodings also of the areas more distant from the river, and input of nutrients by river water can be assumed. The proximity of the Black Sea coast (< 1 km at the nearest point) has a stabilizing effect on the water level at and around Nabada nominated component area.

Ecosystems, habitats and vegetation

The main ecosystem of Nabada nominated component area is the Nabada Mire, a lithogenous water rise mire. It is surrounded by some limited lowland Colchic forest and also includes open freshwater bodies.

The open mire part is characterized by the formations of *Sphagnetum-Caricetum* (*Carex rostrata*) with *Sphagnum papillosum*, *S. palustre*, *Carex rostrata*, *Carex vesicarya, Carex lasiocarpa, Cladium mariscus, Molinia litoralis*. An important association species is *Orchis palustris*. In some parts *Phragmites australis* stands occur (Figure 69). The margins are covered by forests dominated by *Alnus barbata*, *Frangula alnus*, *Rubus* bushwood and *Carex acutiformis*.

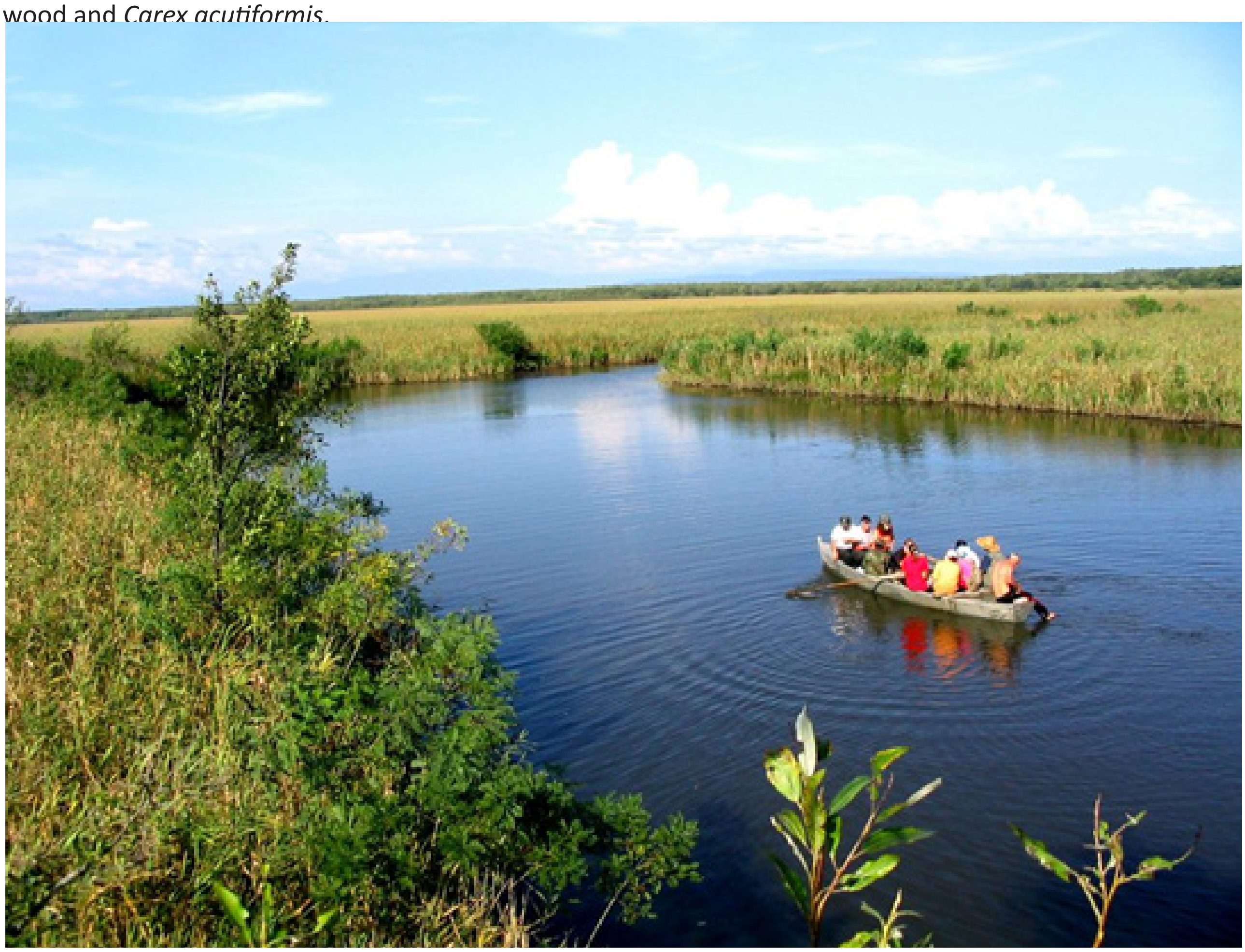

Figure 69. *Phragmites* stands at Nabada mire. (Photo: Matthias Krebs)

The margins of the open mire area consist mainly of *Phragmites australis* stands with heights up to 2.5 m. indicating nutrient input by the adjacent rivers. The dense vegetation of the open mire centre reaches heights of 1.2 m, pointing to a lower nutrient input and reduced river influence.

Flora

The flora of Nabada Mire reflects its relative nutrient richness. Important common species within its flora are summarized in Appendix 2.

Fauna

Apart from the relatively species-poor mire habitats, Nabada nominated component area is mainly notable for its aquatic habitats, some of which are connected to the Khobi river system and afford spawning/nursery areas for fish. Aquatic invertebrates are little studied.

2.a.9 Description of nominated component area No. 7: Churia

Size, location and topography

The Churia nominated component area (1,943 ha) comprises Churia Mire (Figure 70), which is situated 15 km north of the city of Poti and is bordered to the South by the river Khobiskali, and to the North by the river Churia, plus some Colchic lowland forest to the east of it (Figure 6). The component area is separated from the Black Sea by a narrow strip of low coastal dunes. Further information on its boundaries is presented in the textual description of boundaries in the Executive Summary.

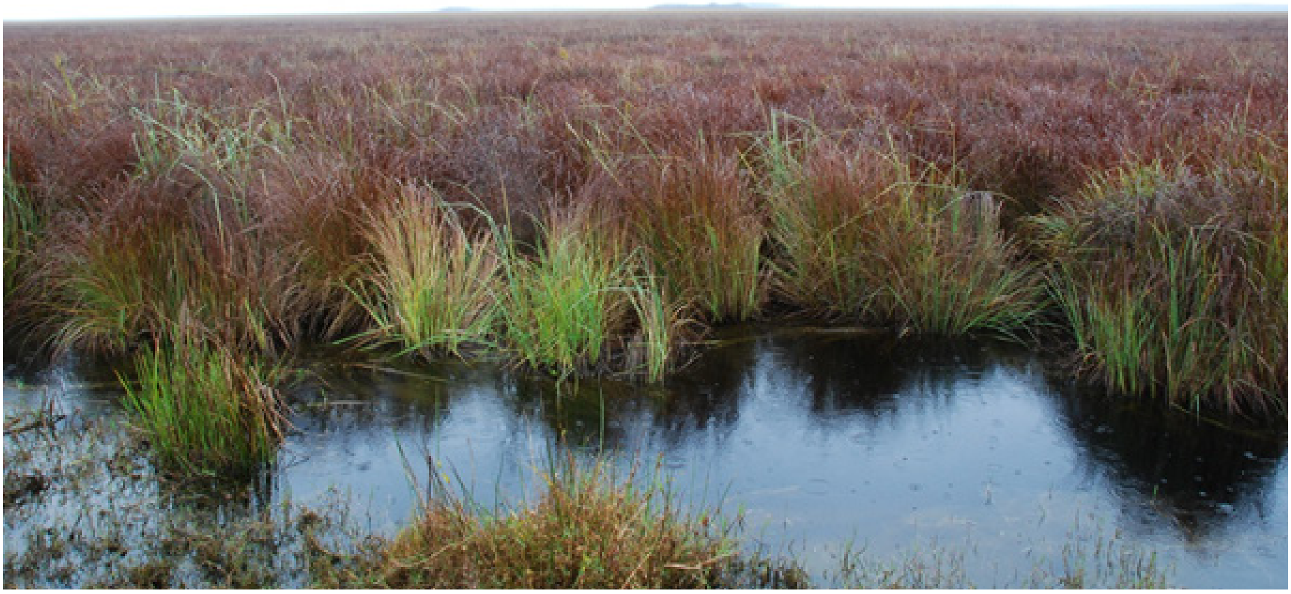

Figure 70. Landscape of Churia Mire, Churia nominated component area. (Photo: Tobias Garstecki)

Beside the dune vegetation in the west it is surrounded by Colchic lowland forest in all other directions (Figure 71). The mire has an extension of 4.5 km from north to south and 4.0 (- 6.0) km from east to west. It includes a 2,500 ha open mire part.

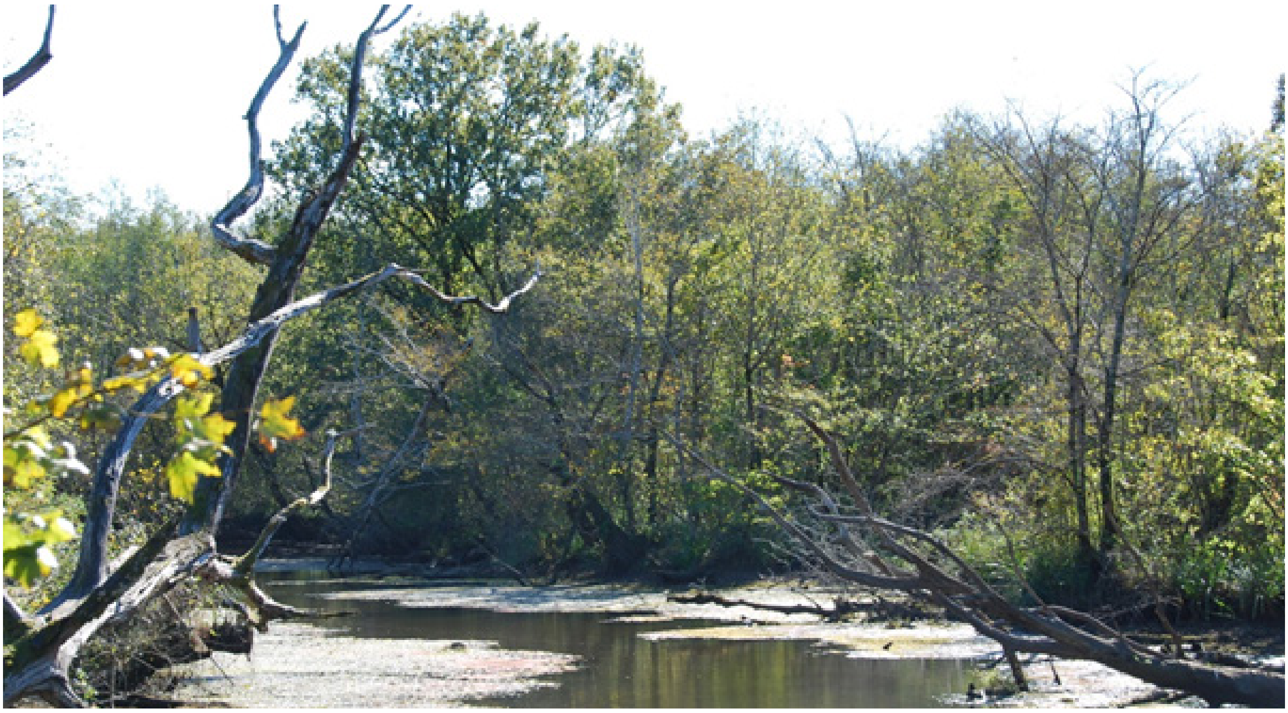

Figure 71. Landscape with Colchic lowland forest and freshwater pond at Churia nominated component area. (Photo: Tobias Garstecki)

Development, structure and function of Churia Mire

This peatland area is situated in a shallow basin, separated from the Black Sea by a low coastal dune. Its mineral subsoil consists of clayish coarse sand. The layer above is formed from different sized clay and gyttjas, with well-preserved plant material that must have been deposited during a period of open water (Figure 72). The deposits of clay gyttja are thin or even partly absent. It is thus assumed that the open water body was situated in a very shallow basin and that the main peat accumulation process was paludification as a result of relative sea level rise (Chepalyga 1984). Peat accumulation began between 6,930 and 5,230 years BP (Timofejew & Bogolyubowa 1998). Mainly root peat with a high amount of Phragmites radicels, but also with remnants of wood, Cladium and Molinia accumulated. The degree of decomposition of the peat varies, but the mean degree of decomposition is H5 – H6 (after Von Post). Peatland development took place under wet conditions and probably good nutrient supply, with periodic changes of the hydrology resulting in wetter phases. This is reflected by the occurrence of detritus gyttja within the peat. Periodical flooding from the adjacent rivers is also conceivable. This is supported by the high content of mineral substances like clay and sand in the peat. The current mean depth of the peat amounts to 5 m with a maximum of 7 m. The peat accumulation rate is high and achieves 1.2 mm a-1 (Dshanelidse 1989). **The Churia Mire can hence be classified as a lithogenous water rise mire (sensu Joosten & Clarke 2002)), which is remarkable for the long-term constant conditions for peat accumulation.**

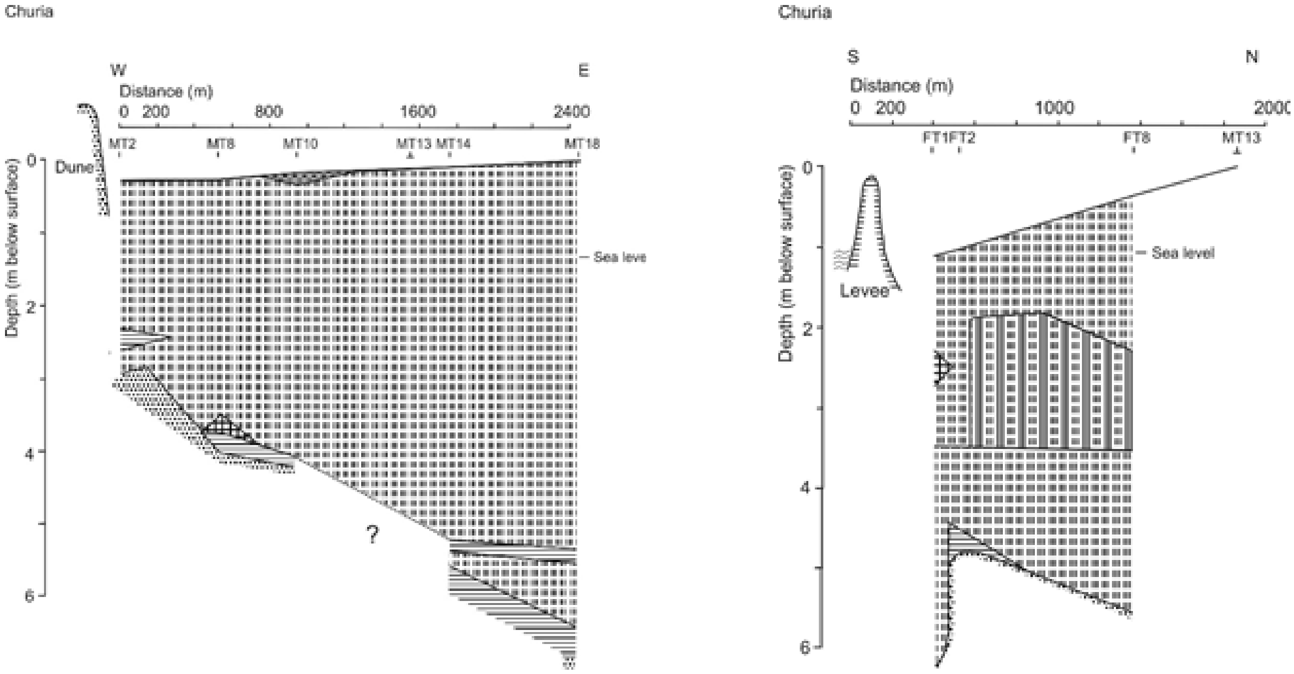

Figure 72. Stratigraphy of Churia mire along a W-E (left) and a S-N transect (right).

Remarkable is a small area in the centre of the Churia Mire with hardly decomposed *Sphagnum* peat in the upper layer, whereas in deeper layers only few remnants of peat mosses were found. Its depth only reaches a few centimetres. It indicates the shift from a nutrient richer lithogenous water supply to ombrogenous water supply with more nutrient poor and acid conditions.

Physical and chemical conditions: The recent macrorelief of the peatland slightly slopes from East to West and from North to South. Its surface is situated at approximately 1 m a.s.l. Thus the main water movement is assumed to be laterally to the Sea and the river Churia. The microrelief consists of tussocks of 10-45 cm height, which decreased towards the centre of the mire. The tussocks indicate water level fluctuations, which will be connected to the high degree of peat decomposition.

At the southern margin the Churia Mire has a similar height as the Black Sea and is below the mean water level of the nearby Khobistskali River, only separated by an 80 cm high river bank of 150 m width. Thus the

Churia Mire is periodically flooded by the river. The water level seems to be high, but data are absent. The differences in water level in the mire are small and range around 40 cm. The pH of the pore water is 4.0-5.7, and the EC values 90- 200 µS cm^{-1}, reflecting a predominance of rainwater supply to the top of the mire system. It can be assumed that the lithogenous water supply from the east and north is filtered by the adjacent peatland forests.

Climate

The climate of Churia nominated component area is typical of the Colchic Lowlands, i.e. warm-temperate and highly humid, with < 1,900 mm of annual precipitation (Figure 57).

Hydrology

The peatlands and forests at Churia nominated component area are fed by atmospheric precipitation and river water. The mire has a hydrological connection to the Khobistskali and Churia River systems to the north and South. The proximity of the Black Sea coast (200 m at the nearest point) has a stabilizing effect on the water level at and around Churia nominated component area.

Ecosystems, habitats and vegetation

The vegetation is formed by the formations of *Sphagnetum-Caricetum* with *Sphagnum papillosum*, *S. palustre, S. fallax, S. denticulatum, Carex rostrata, Carex vesicaria, C. lasiocarpa, Cladium mariscus, and Molinia litoralis.* Vegetation is largely homogenous and dominated by *Carex elata and Molinia litoralis*. Sedges and moor grass are partly accompanied by a peat moss layer constituted by Sphagnum spp. Approximately one hectare of large nearly pure stands of *Cladium mariscus, Phragmites australis or Calamagrostis epigejos* associated with *Lysimachia vulgaris* and *Lythrum salicaria* are typical for the vegetation. Remarkable is a very dense peat moss lawn consisting of *Sphagnum palustre* and *S. papillosum* accompanied by *Menyanthes trifoliata, Drosera rotundifolia* and *Molinia litoralis* in the centre of the Churia Mire, indicating ombrotrophic conditions.

The Colchic lowland forests of this component area are similar to those of Pitshora nominated component area.

Flora

The flora of Churia Mire consists of 45 vascular plant species and 8 moss species (Appendix 2). A special feature is the occurrence of the rare and endemic species *Hibiscus ponticus* (Figure 73).

Fauna

Similar to Nabada nominated component area, Churia nominated component area is relatively poor in species of fauna and mainly notable for its aquatic habitats, which are connected to the Churia river system and provide valuable spawning areas for fish. Aquatic invertebrates are little studied.

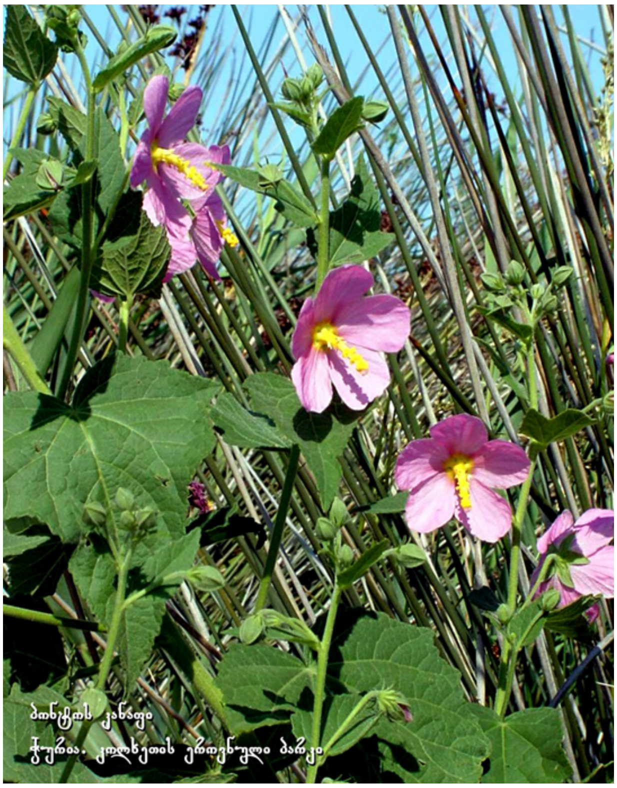

Figure 73. The critically endangerd local endemic *Hibiscus ponticus* at Churia Mire, Churia nominated component area. (Photo: Izolda Matchutadze)

2.B HISTORY AND DEVELOPMENT

The ecosystems, vegetation, flora and fauna of the Colchic Rainforests and Wetlands have been shaped by a series of key events in several distinct periods of the history of Earth, and need to be understood in this context. Being situated in an area that has been inhabited for millennia, they have also been affected by humans during their more recent history. The following key phases of the history and development of the Colchic Rainforests and Wetlands need to be distinguished:

2.b.1 Glaciation refuge during glaciation cycles of the Pleistocene

The Colchic Forests and Wetlands cannot be understood without their geological and climatological pre-history, which has profoundly affected their evolution: During the Paleogene, climate in the northern hemisphere was warm and wet and rich subtropical and tropical woody plants were distributed here. Global cooling which started approximately 15 million years ago (Moran et al. 2006) then culminated into cooling cycles. Therefore woody plants migrated southwards and survived only in refugia, places in which the climate remained relatively warm and wet during the Ice Age. Such refugia are situated in eastern Asia, south-eastern North America, south-western North America and western Asia.

Similar to the Hyrcanian Forests along the southern coast of the Caspian Sea, the western Caucasus and especially the Colchic Area, as a part of western Asia, represents one of the outstanding global Ice Age refugia. This is proven by evidence coming from current distribution of plants and animals considered to be “relict” (van Zeist & Bottema 1991, Tuniyev 1990, Zazanashvili et al. 2004, Milne 2006), by fossil, specifically palinological evidence (Adams & Faure 1997, Connor 2011, Connor et al. 2007, Shatilova et al. 2011), by phylogeographic patterns of various organisms (Weisrock et al., 2001, Veith et al. 2003, Milne 2004, Zakšek et al. 2007, Aguirre-Planter et al. 2012, etc.), and by ecological modelling (Tarkhnishvili et al. 2012 – see also Tarkhnishvili 2014, for a recent review). This explains the extremely high – for a non-tropical continental region – proportion of endemic and relict species within the flora and fauna of the Colchic Rainforests and Wetlands, such as the high proportion (>70%) of endemic species among mountain forest snails of the Western Caucasus (Pokryszko et al. 2011). The proportion of relict and endemic species of amphibians, reptiles, and small mammals exceeds 20% if the entire fauna is considered. The same applies to vascular plants and freshwater fish (Tarkhnishvili & Chaladze 2013, Tarkhnishvili 2014).

“True” relict species are those which are members of the groups with disjunct distribution, such as evergreen shrubs whose closest relatives are commonly in East Asia or North America. Milne (2004) showed that of five species of the western Caucasus Rhododendron, neither are closest relatives to each other, but their sister species currently exist in East Asia, Indochina, and Appalachian Mountains in the USA. Similarly, endemic amphibians such as Caucasian salamander and Caucasian parsley frog have closest relatives at the Atlantic coast of Europe (Weisrock et al. 2001, Garcia-Paris et al. 2003). Many other examples are provided crustaceans, butterflies, reptiles, amphibians, and small mammals (Tarkhnishvili 2014).

The Colchis is not a uniform refugial area and supposedly is comprised of several once distinct refugia differing from each other by species and genetic diversity. This is in line with the concept of cryptic refugia by Provan & Bennett (2008), suggesting that molecular genetic/ phylogeographic studies help to understand finer structure of refugia roughly identified by older traditional methodologies. Tarkhnishvili et al. (2001) showed that the salamander populations from the Black Sea coastal mountains and from the Borjomi-Kharagauli National Park area differ genetically to an extent suggesting they have been separated for over 5-7 millions of years. A similar pattern was later shown for the Helix buchi species group, a group of large endemic beach snails (Mumladze et al. 2013). This refugium has also been described as a network of smaller refugia by some authors. As a consequence, the Colchic Forests and Wetlands harbor many relict woody and herbaceous plants, e.g. plants which were widespread in Europe many millions of years ago and became extinct there during the Ice Ages (Radde 1899, Grossheim 1936, Flerev 1951, Kolakovskyi 1961, Zohary 1973, Nakhutsrishvili 1995, Shatilova & Rukhadze 1995, Denk et al. 2001, Milne 2004, etc).

The past isolation among individual mini-refugia described in the previous subsection triggered the development of genetically distinct evolutionary lineages (species) with a very limited distribution, such as the two forms of Caucasian salamander (Mertensiella caucasica), or two sister species of large terrestrial snails (Helix buchi and H. goderdziana). The isolation during unfavourable climatic periods, such as glacial maxima, leads to genetically distinct forms that, after re-establishment of the contact among the lineages, deepen the divergence as a result of character displacement and reinforcement, the evolutionary mechanisms leading to speciation (Bell 2008).

The Colchic Lowlands are also important with regard to the ongoing evolution of glacial relict species, as several species are known to have there and then dispersed in Europe after the melting of the ice. One example from the Colchic peatlands is the species Sphagnum austinii. It has been suggested that this species re-colonized Europe after the glaciations from the Colchis. It is is a main peat forming species in Ispani and Imnati nominated component areas (Dokturowski 1931, 1933, Potskhishvili et al. 1997, de Klerk et al. 2009). From 800 years BC onwards, its massive occurrence in the bogs of Central and Western Europe (Overbeck 1975) led to the accumulation of slightly decomposed Sphagnum peat (“white peat”). In recent centuries, the species has become extremely rare in Europe (Green 1968), its massive decline being ascribed to climate change, fires, and eutrophication (cf. Mauquoy & Barber 1999). In the Ispani 2 and Imnati mires, the widespread dominance of Sphagnum austinii (Haberl et al. 2006, Kaffke 2008) enables the study of vegetational characteristics and peat accumulation processes of this species.

2.b.2 Paludification of the Colchic Lowlands during the Holocene

Peatlands have been present in the Colchic Lowlands for a long time. Peat layers in the littoral part of Kolkheti at a depth of 62-65 m b.s.l., and in the Paliastomi Lake and Patara-Poti areas at 120-160 m b.s.l., have been estimated to be 31,000 and 80-140,000 years old, respectively (Dzhanelidze 1980). Present-day peatlands are much younger, and have developed due to the rise of the Black Sea water level and the subsidence of the Kolkheti lowlands (Svanidze 1989). Mire development generally began with the terrestrialisation of an aquatic environment, most likely a coastal lagoon or lake, separated by sand dunes from the Black Sea, at 5,230-6,930 BP (e.g. Nabada, Churia, Imnati; Timofeyev & Bogolyubova 1998).

2.b.3 Human impact since the Neolithic period

According to the earliest records of human inhabitation available, Colchic tribes were known as skillful farmers, cattle-breeders and metallurgists. Various archaeological discoveries, as well as ancient oriental and Georgian manuscripts testify to an early economical, social and cultural development of the Georgian people in this area. According to these data, the leading branches of economy were (1) agriculture (field crop cultivation, vine making, horticulture, vegetable growing, etc.); (2) cattle breeding; (3) domestic craft (weaving, wood work, blacksmith work, textile production, pottery, ceramics, etc.). The diversity of climate and relief of the Colchic Triangle has also been highly important for its economic development since the early stages of human activities, which in turn have helped shaped the current landscape. Numerous rivers promoted intensive agriculture even without irrigation. Besides, these rivers served as trade-routes. Due to their rapid current, the rivers were used for transportation of timber. Vakhushti Bagrationi, the prominent Georgian historian and geographer of the 18th Century, distinguished two botanical and agricultural zones within the Colchic area: the mountainous and the lowland one. Since the Neolithic revolution, these two zones represented one closely integrated system. The lowlands were characterized by rich harvest of grain crops, vineyards and orchards. In the mountainous areas the harvest of grain crops was much poorer, vineyards and orchards were absent. Lowland forests surrounding the peatlands of the Colchic Lowlands formed a continuous forest cover until the early-mid-20th Century, but were felled for architecture after that. There was also some peatland draining for mechanized agriculture during this period (Connor et al. 2007), which – at least for the nominated component areas within this zone – has been reversed since.

2.b.4 Protected areas history since the 20th Century

In terms of the nature protection history, the protected areas contributing to the series were established between 1959 and 2012 (Table 9). The first one was Kintrishi Strict Nature Reserve in 1959, which became one of the best preserved PAs and main points of reference for biodiversity research during Soviet times (Balandin et al. 1990). Georgian independence in 1991 triggered another wave of PA establishment, with the designation of Kobuleti Protected Areas and Kolkheti National Park in 1998 and Mtirala National Park in 2006.

Table 9. History of protected areas contributing to the protection of the nominated component areas of the Colchic Rainforests and Wetlands.

Protected Area	**Year of establishment**	**Re-designations**
Mtirala National Park	2006	No
Kintrishi Strict Nature Reserve	1959	In 2007 part of the reserve was designated as Kintrishi Protected Landscape. A re-designation of parts of Kintrishi Strict Nature Reserve and the entire Protected Landscape as a National Park (with a nested Strict Nature Reserve), and re-zoning is underway, and will be concluded in mid-2019. This will not lead to a reduction of the overall area under strict protection in Kintrishi.
Kobuleti Protected Areas (Strict Nature Reserve and Managed Reserve)	1998	no
Kolkheti National Park	1998	no